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EDITORIAL

Alternate Metabolic Pathways

CHEMISTRY is part of surgery: antithyroid drugs are used in preoperative preparation, hormones are used for metastatic cancer of the breast and Thio-TEPA passed through a catheter to the hepatic artery controls metastatic cancer in the liver. The orthopedist uses relaxing drugs for spastic muscles and the abdominal surgeon may use androgenic hormones postoperatively to speed the restoration of a positive nitrogen balance. Because the surgeon's scalpel must be coordinated with many adjuncts of therapy that affect body metabolism, he is interested in changes within the cell. The surgeon is further concerned with variations in the substrate of the cell in health and in disease. It is of interest that there are alternative pathways of metabolism in the vital processes of living tissue characteristic of health, of disease, and of birth.

The event of birth is a massive physiologic changeover. The unborn child pursues his parasitic existence, taking nutrition and oxygen through the umbilical cord. It cannot be assumed that he feels thirst or hunger or has consciousness, his stirrings being only the inevitable movement of life; but at birth his loud cry, appearing to register protest, fills his lungs with oxygen. The amount of oxygen he can get by respiration is increased many times over the maximum obtainable through the placenta. His growth and function in the uterus were geared to a low oxygen supply. That fetal tissues even resent oxygen is shown by the response of the premature infant in whom retrolental fibroplasia and blindness develop when the infant is placed in an oxygen atmosphere of over 40 per cent. Geared for anaerobic metabolism, the fetal tissues become overstimulated by excess oxygen and produce a pathologic disorder. Experimentally, newborn mice placed in an atmosphere of nitrogen for forty-five minutes are fully revived when returned to a normal atmosphere. With the aerobic pathway of metabolism possible after birth, the energy of maximum physical activity is possible.

The clinical importance of alternative anaerobic and aerobic patterns of metabolism is shown by Warburg's hypothesis of cancerogenesis. He assumes that the cancer cell is one in which energy transformation is accomplished by the embryonic mode of anaerobic metabolism and the cell also assumes the energetic growth capacities of the embryo. The hormone treatment of metastatic cancer of the breast effects a competitive inhibition of enzymes that would choose the metabolic pathway of cancer growth.

Living tissue sustains itself by drawing energy from its environment. Living cells have survived many types of environment with the aid of enzymes that make possible adaptation to changing conditions. The living cells of a complex organism have for environment the connective tissue of the body. The most primitive connective tissue is the intercellular material of the jellyfish or intercellular matrix of the early embryo. The embryonic characteristic of abundant interstitial gel-like substance is demonstrated in the appearance of the umbilical cord. While the amount of intercellular substance of the body is still large in the infant, it is diminished in the adult and scanty in the aged person. Besides a quantitative change in

intercellular material (ground substance) as life progresses, there may be changes in the character of this material. It is an amorphous water-holding gel in constant build-up and breakdown; it forms the basement membrane and is important in membrane permeability and physiologic exchanges.

While the bones, joints, and fascia of the connective tissue are obvious supportive structures, this system is also active in the nutrition and defense of the body. Transport of materials to the cell to meet energy requirements must be from the blood stream through the basement membrane. The changing conditions from quietude to activity, from rest to stress, from disease to health depend on responding ground substance to effect the transport of these materials. The importance of the steroids in metabolism, whether they come from the gonads, adrenal glands or from other sources has become apparent in clinical practice. The clinical effectiveness of cortisone and other steroids emphasizes the importance of abnormal steroid metabolism in disease. Steroids in therapy may restore the metabolism to desirable pathways standard in the adult cell. Yet cortisone also induces peptic ulcer and diabetes.

Growth is attained in the embryo and infant by the synthesis of nucleoproteins within the cell. Energy is produced by the consumption of glucose and other materials. The amount of energy produced depends on the amount of oxygen that may be utilized. This requires the action of high energy phosphate compounds, including adenosine triphosphate. Steroids act to speed the transformation of hexose 6-phosphate to triose through a phosphoglycerate path rather than through a phosphogluconate path. Steroids also act with the dehydrogenase enzyme and the cytochrome oxidase enzyme to produce energy quickly. For example, energy transformations must be almost instantaneous to make possible efficient transmission of nerve impulse. Brain function must be maintained by highly efficient utilization of oxygen. Abnormal body chemistry that leads to convulsions may be a result of energy transformation through undesirable metabolic pathways. The ideal conditions that produce normal function must depend on the correct balance of extracellular conditions mediated in the connective tissue system.

Connective tissue provides the substrate for epithelial, nerve and muscle cells. It supplies the mechanism of immunity which determines relative susceptibility to cancer. It is the area in which abnormal steroid metabolism is primarily felt, adaptive reactions of the organism are made, collagen diseases occur and it is the area in which cortisone acts. It is the system that goes into action when wounds heal. It transports actively from the blood stream the materials used in the cell. The surgeon is interested in its effect on metabolism.

Within the cell, the citric acid (Krebs) cycle is in continuous process to convert carbohydrates for cell function. Lipids become involved in the cycle through an acetyl coenzyme A. By these methods living cells consume nutrients, produce energy and regain the steady state (homeostasis) of continuing existence. However, changes in the interstitial space transport mechanism (the connective tissue substrate) may result in varying selection of available metabolic pathways through the competitive inhibition of different adaptive enzymes. Problems of the degenerative diseases of the musculoskeletal system and the healing of wounds are involved and are of surgical interest. Wound healing is part of the post-traumatic response or alarm action.

The chronic effects of alarm and stress may be factors in the etiology of such surgical entities as peptic ulcer, ulcerative colitis and regional enteritis. When the overstimulation of modern life affects the function of the primitive brain stem or thalamus, some of the alarm reaction effects are controlled by tranquilizing drugs. The use of these today produces a chemical alteration of personality. Whereas alcohol used to be the universal alterative of the human race for diminishing man's acute awareness, the tranquilizers produce similar changes without similar penalties.

The increasing requirement for exact pharmacotherapy as a part of preoperative and postoperative care requires the surgeon to be familiar with biochemistry. The surgeon's healing touch involves not only a familiarity with the total personality of his patient but also with the processes that go on within the cell and the arrangement that makes it possible for a complex organism of many different tissues to function, namely the connective tissue system.

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Superior Vena Caval Obstruction*

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OBSTRUCTION of the superior vena cava is associated with an increase in the venous pressure of the upper half of the body and with a gradual development of collateral circulation by which the blood finds its way back to the heart. The signs and symptoms characteristic of the clinical picture result from the high superior central venous pressure. These are edema of the upper half of the body, stasis of the blood, cyanosis of the face and arms, and enlargement of the collateral veins. Until the past fifteen to twenty years, there has been no effective treatment for these very distressing symptoms, unless, perhaps, the obstruction was caused by a radiosensitive tumor. The development of new technics in vascular surgery has made possible the relief of the obstructive symptoms by vascular grafting. Thus, a review of superior vena caval obstructions is in order, now that surgical procedures have been devised to relieve the obstruction.

In 1757 William Hunter [1] gave the first clear description of superior vena caval obstruction. In 1904 Julius Fischer [2] collected all of the cases published in a comprehensive review of the subject. He found that in one hundred sixty-six cases the obstruction occurred above the azygos junction in fourteen, included the azygos junction in 121, and occurred below the azygos junction in thirty-one. In 1935 Ochsner and Dixon [3] reviewed 120 cases of venous obstruction caused by superior vena caval thrombosis. McIntire and Sykes [4] in 1949 collected all of the cases of superior vena caval obstruction published up until 1946. Their review included 524 cases. In 1925 Veal and Cotsonas [5] reported their experience with superior vena caval system obstruction over a fifteen-year period at the Gallinger Hospital. Sixty-one obstructions involved either the superior vena cava or the innominate veins. The vast amount of information collected in the above reviews need not be repeated in this review which has as its objective the presentation of material which is primarily of surgical import.

In 1934 important observations on venous pressure and collateral circulation were made by H. Carlson [6]. In the experimental laboratory he found that the dog could survive obstruction of the superior vena cava above the level of the azygos vein. Obstruction below the azygos vein could also be tolerated provided it was done in two stages. The importance of adequate collateral circulation in survival of the animal was recognized and the azygos vein played a singularly important role. The edema and cyanosis due to superior vena caval obstruction disappeared if an adequate collateral circulation developed. Pleural fluid accumulated and caused increased respiratory distress when the obstruction was above the level of the azygos. The many veins involved in the formation of the collateral circulation were also described in detail.

In 1947 Gerbode [7] utilized the azygos vein as a shunt around a superior vena caval obstruction produced by a ligature. This was effective in relieving this localized obstruction but, as Fischer pointed out, most of the obstructions in man include the azygos vein or occur below it. Thus the superior vena cava

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was anastomosed to the right auricular appendage and was found to effectively relieve acute and chronic superior vena caval obstruction.

Since anastomoses in the venous circulation are more prone to stricture and thrombosis, an everting suture should be used and care must be taken to prevent suture material from being exposed inside the vein where it may form the nidus for a thrombus. Suturing a graft to a vein with roughened intima following thrombectomy lessens the chances for a functional shunt.

Gerbode concluded that venous shunts to the atrium were technically possible and that those of large enough caliber remained patent. Some degree of fibrosis always occurred at the site of anastomosis to the atrium and this was enough to obliterate a small shunt. This degree of narrowing was not great enough to cause symptoms in seven dogs in which postoperative thrombosis did not develop. Some of the patients with atriocaval shunts were followed up for more than five years [*8*]. A superior vena cava to auricular appendage anastomosis was demonstrated to be smooth when the animal was sacrificed two and a half years later. On the other hand, arterial homografts placed in the superior vena cava of twenty-five dogs were subject to thrombosis or gradual fibrosis in every instance. Gerbode pointed out that one of the reasons for thrombosis and narrowing of the grafts in the venous system was the absence of a systemic pressure.

While Gerbode preferred to use an autogenous vein graft for the vena cava, Kay [*8*] performed homografts of vena cava in the experimental laboratory in 1948. All the grafts worked initially. Venograms four to six months postoperatively revealed a patent vena cava transplant in 30 per cent of the dogs. At six months all of the grafts were sclerosed and none were adequate by the time the animals were sacrificed.

In 1951 Deterling [*8*] used aortic homografts preserved in nutrient electrolyte solution at 4°C. He stated that all of the grafts functioned and were endothelialized although in some instances there was corrugation of the graft. One dog had a functioning graft for seven months. Ashburn, Sewell and Huggins [*9*] had successfully functioning arterial homografts in five dogs which did not thrombose immediately postoperatively. The longest follow-up was only five months, however. The upper end of the graft was sutured to the superior vena cava above and the lower end to the right auricle below. The grafts endothelialized but a stricture at the anastomosis to the atrium was sufficient to cause elevated venous pressure and in two dogs caused pleural effusion also. The lumen at the atrial anastomosis was only ⅓ to ¼ of its original diameter. A patient with a superior vena caval obstruction from carcinoma was treated by Ashburn, Sewell and Huggins by anastomosing a frozen, dried porcine aortic graft to the proximal superior vena cava above and to the intrapericardial segment of superior vena cava below. The patient returned to work and had no recurrence of the edema of the face and upper body seven months after operation. This certainly suggests a patent heterograft.

Richards and Smith [*10*] used a crimped nylon bifurcation graft inserted from the innominate veins above to the right auricular appendage below. Although the outlook for successfully functioning plastic prosthesis in the venous system has not been considered good [*11*], this graft has functioned adequately in this patient for four months.

Thus venous autografts, venous homografts, preserved homologous and heterologous arterial grafts, fresh arterial homografts, and a crimped nylon prosthesis have all been grafted to replace part or all of the superior vena cava with varying degrees of success both in the experimental animal and in man.

Clinical Picture. The work done in the experimental laboratory has increased our understanding of the clinical picture associated with superior vena caval obstruction. The increased venous pressure causes dilation of the veins over the upper half of the body. Edema and cyanosis of the upper half of the body is also noted. There is respiratory distress, headache, and somnolence from congestion of the brain. The respiratory distress is increased by the edema of the neck and glottis, plus pleural effusions as well as by the increase in CO_2 content of the blood in the respiratory center. The eyes bulge and the lids are edematous. There may be syncope and even Jacksonian convulsions from cerebral thrombosis. The cerebrospinal fluid pressure is elevated. All symptoms are increased by bending forward and, indeed, many of these patients sleep sitting up since they become dyspneic with recumbency, and coughing, choking, dizziness

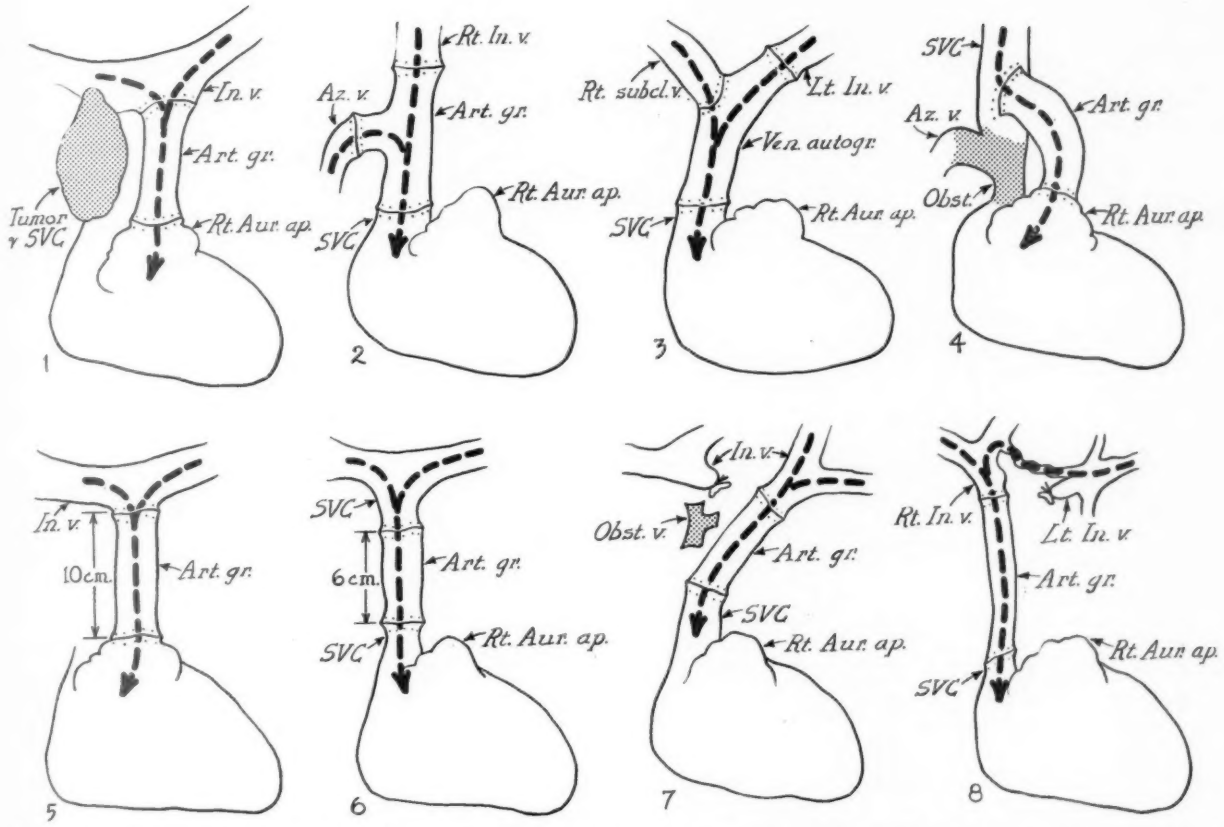

FIG. 1. (1) Metastatic sarcoma. Patient died after six weeks. Graft patent. (2) Benign obstruction. Patient was asymptomatic postoperatively. (3) Benign obstruction. Patient was asymptomatic for one year. (4) Obstruction from malignancy. Patient died in four months. Graft patent. (5) Benign superior vena caval obstruction. Graft thrombosed, one month. Patient lived. (6) Idiopathic obstruction. Patient alive and well at five months. (7) Fibrosis after mastectomy and x-ray treatment. Good result, fourteen month follow-up. (8) Chronic fibrous mediastinitis. Good result, ten month follow-up.

and increased cyanosis result when they are not propped up.

There is no change in the hemogram. A trace of protein is often noted on urine examination. This is attributed to increased pressure in the renal vein due to the blood flow contributed by the collateral circulation.

Radiographic examination usually reveals a widened mediastinal shadow. A tumor or aneurysm may be obvious with the use of routine films, or tomography may be required to visualize a mass. Occasionally the azygos vein may be outlined in this manner. Phlebograms usually reveal a maze of collateral vessels and a block at the thoracic inlet. If patency of the azygos system can be demonstrated or if the exact location of the obstruction is revealed the information is valuable to the surgeon in determining the prognosis and surgical approach.

Although the venous pressure is obviously elevated, it should be measured in order to determine whether the block is increasing or whether an adequate collateral circulation is developing. Venous pressures of 300 to 500 mm. of saline are common in the antecubital veins, the venous pressure in the saphenous veins being normal. Partial obstructions of the superior vena cava are more common than is generally realized [*12,13*] and the prominent veins may be the first signs of a space occupying mediastinal lesion.

Excellent reviews of the collateral circulation have been written by Hallett [*14*], Fischer [*2*], Carlson [*6*], Ochsner and Dixon [*3*], Ehrlich and Ballon [*15*], Gray and Skinner [*16*] and others. Carlson demonstrated that the development of the collateral pattern depended upon the situation of the occlusion. The collateral vessels may be divided into the superficial and deep vessels, or into thoracoabdominal, vertebral and mediastinal groups; the

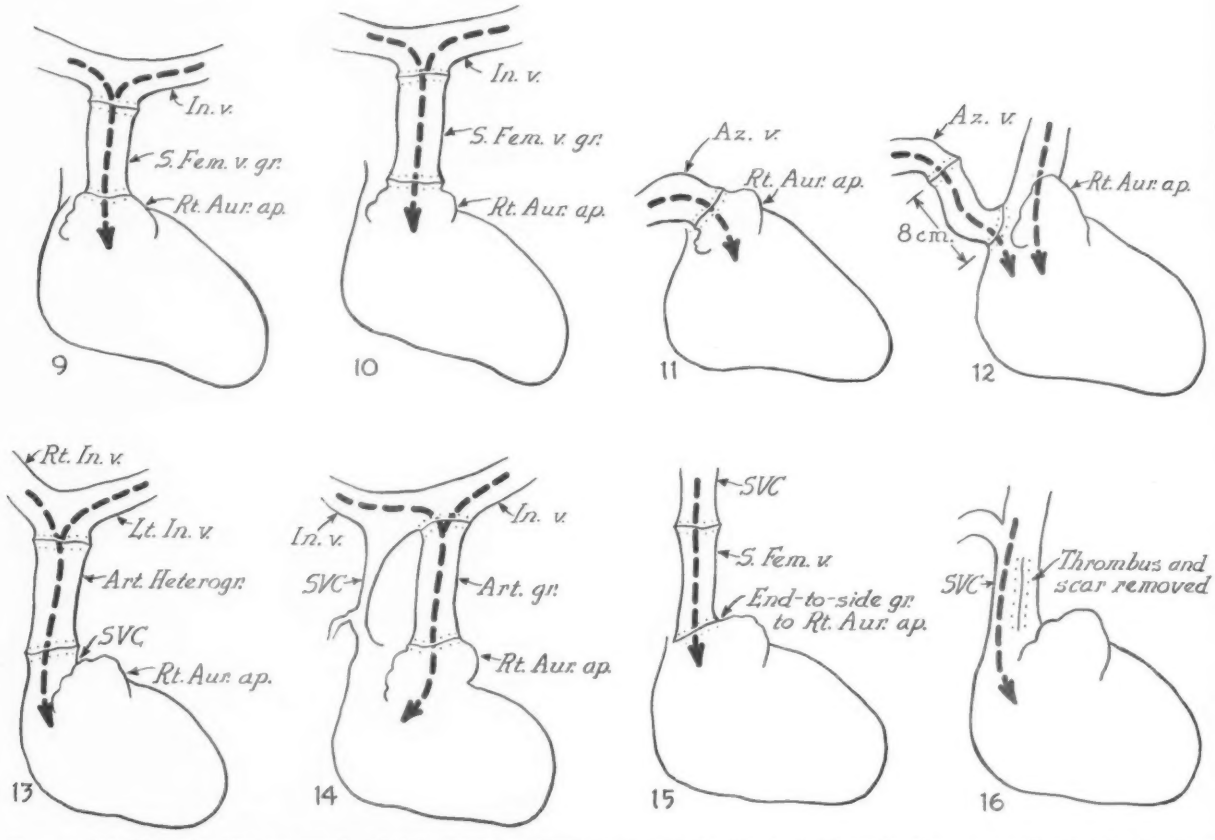

FIG. 2. (9) Chronic fibrous mediastinitis. Patient died postoperatively. (10) Chronic fibrous mediastinitis. Patient alive at five years. Non-functioning graft. (11) Patient died in four months. Graft sclerosed. (12) Obstruction from lymph node. Patent by venogram, six months. (13) Obstruction from tumor. Patient asymptomatic, seven month follow-up. (14) Cancer of right lung. Obstruction relieved, five months. (15) Mediastinitis. (16) Post-thoracotomy scarring. Patient asymptomatic one year. Graft patent (?).

azygos system, composed of a variable group of deep veins in the mediastinal group, is the most important.

If the obstruction includes the azygos vein, and it usually does [2] the blood flow in the remainder of the azygos system and in the superficial and deep collateral veins carrying blood to the femoral and iliac veins or to other veins communicating with the inferior vena cava is prominent in a caudal direction.

In a small number of cases in which the occlusion is above the azygos vein a prominent venous plexus develops over the sternum seeking the perforating branches of the internal mammary veins and thence to the azygos system via the intercostal veins. Since this route is less circuitous, it is more efficient and the signs and symptoms are much less severe. Pleural effusion may be troublesome in this group. A partial obstruction at this level may be handled by the deep veins, the superficial veins being enlarged very little.

If the superior vena cava is occluded below the azygos vein, or if both the superior vena cava and azygos systems are obstructed, the blood from the upper half of the body must take a very circuitous route in order to return to the heart through the inferior vena cava. Large collateral vessels extend from the thorax to the abdomen and groin. The pressures in this group are very high and the disability is profound.

The venous pressure increases with exercise if a block is present [5]. Increased venous pressure caused by heart failure does not show a significant increase with exercise. The rate of return of the venous pressure to the resting level is an indication of the adequacy of the collateral circulation.

If a tourniquet is applied to the chest, constricting the superficial thoracoabdominal vessels, and the venous pressure rises with inspiration, the block is distal to the azygos vein. The rise in pressure on inspiration re-

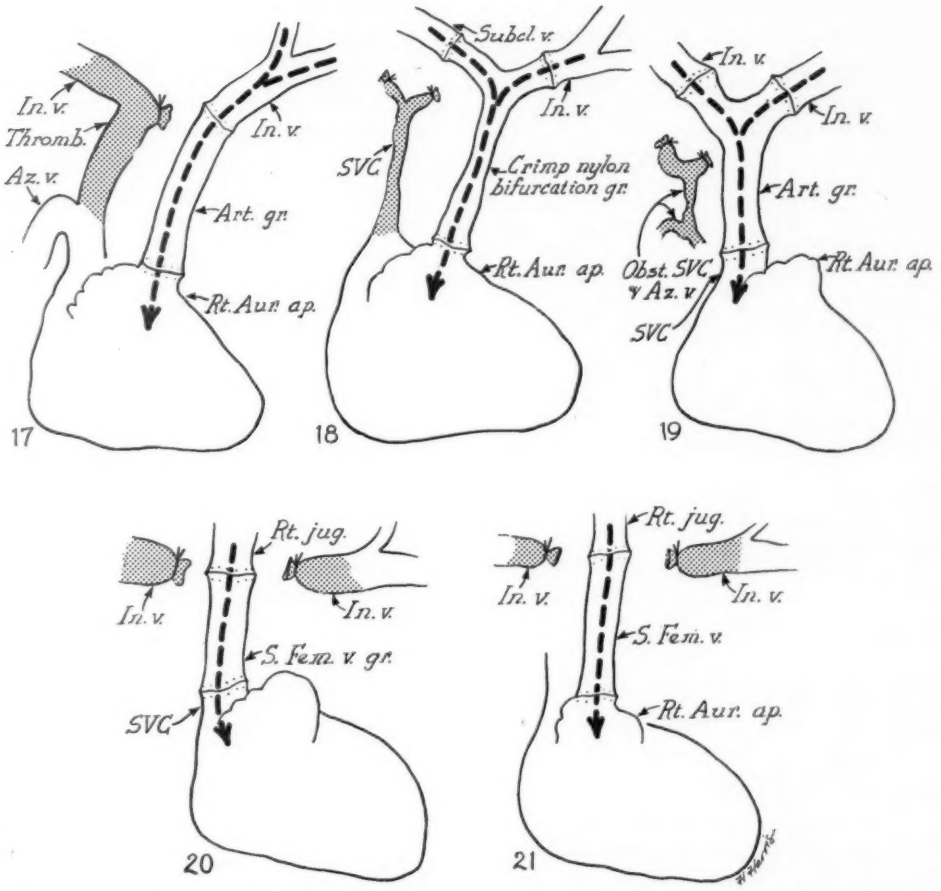

FIG. 3. (17) Idiopathic thrombosis. Patient asymptomatic, one year follow-up. (18) Chronic fibrous mediastinitis. Patient asymptomatic, four month follow-up. (19) Non-specific granuloma. (20) Postradiation fibrosis. Patient died with patent graft after eight days. (21) Organized hematoma (?). Good decompression, one year follow-up.

flects the inferior vena caval pressure and is an indication that the blood is returning to the heart via the inferior vena cava.

Prognosis. The prognosis depends upon: (a) the cause of the obstruction, (b) the location and rate of obstruction and propagation of the thrombosis, and (c) the adequacy of the collateral circulation which develops.

Mediastinal tumor is still the most common single causative factor. The incidence of obstruction due to aortic aneurysm, mediastinitis, postirradiation fibrosis, idiopathic venous thrombosis and phlebitis is not the same today as it was when the large collections of cases were reported and tabulated. A relatively minor degree of obstruction may cause severe disability if it develops rapidly, whereas a slowly developing obstruction may cause no symptoms. Even complete obstruction may be compatible with life if it develops slowly. Of Ochsner and Dixon's 120 patients with obstruction due to venous thrombosis, eighty-five died [3]. The over-all mortality of the severe obstructions is probably between 70 and 80 per cent regardless of cause.

Treatment. With the development of blood vessel grafting, the treatment of superior vena caval obstruction may be divided into surgical and non-surgical therapy.

The non-surgical therapy will be considered first. Favre [17] in 1918 reported improvement of symptoms after antisyphilitic therapy. With the advent of penicillin the response should be even greater in the occasional obstruction caused by syphilitic mediastinitis and aneurysm. Tuberculous and bacterial mediastinitis should also be improved by antibiotic and chemotherapy. X-ray therapy and chemotherapy are very effective in certain susceptible tumors such as the lymphomas.

The surgical treatment consists of: (a) phlebotomy, (b) mediastinal decompression, and (c) vascular grafting.

The most simple surgical measure, phlebotomy, may be lifesaving when obstructive symptoms are acute. In 1922 Chiray and Semelaique [*18*] reported that drawing blood from the jugular vein was effective in warding off Jacksonian epileptic seizures, and gave symptomatic relief. Waterfield [*19*] in 1928 reported relief of Biot respiration by phlebotomy.

Beneficial results from mediastinal decompression have been reported by Gray and Skinner [*16*], Ehrlich and Ballon [*15*], Ochsner and Dixon [*3*], and Guleke [*20*]. This measure does afford some relief when the obstruction is due to outside pressure from a mediastinal tumor. The results are unsatisfactory if the tumor has invaded the vena cava or if fibrous tissue or tumor has encircled the vena cava. The effectiveness of recanalization of the vena cava after the perivenous pressure has been relieved must be more apparent than real, since the vascular lumen is never completely restored and the relief afforded by the collateral circulation is considerable.

The recent development of vascular anastomoses and grafts permits a direct attack upon superior vena caval obstruction. Twenty-one patients have had almost immediate relief of symptoms following surgical procedures designed to relieve the obstruction and establish an adequate shunt. These cases are reviewed in diagrammatic form (Figs. 1, 2 and 3). A study of the diagrams reveals that no two cases are exactly alike. By adapting the procedure to the type and location of the obstruction a shunt is accomplished without destroying valuable collaterals, such as a patent azygos vein, which will form an important part of the collateral circulation in the event that the shunt becomes obstructed. Because strictures form at the site of anastomosis of a graft to the auricular appendage, the utilization of the intrapericardial portion of the superior vena cava has been preferred whenever it is available. In the event that the obstruction is high and no proximal vessel is available within the chest, the jugular vein may be used as the proximal vessel. This maneuver permits decompression of the head and neck and affords symptomatic relief to patients who would otherwise be inoperable.

In Table 1 the encountered causes of the obstructions are listed. Note that four were due to malignant tumors and the remainder to other causes. The type of graft used is tabulated in Table II and the site of the shunt to the heart is tabulated in Table III. The duration of the follow-up varies, but in all the cases there was adequate initial function to relieve the acute symptoms. The venous

TABLE 1
SUMMARY OF PATHOLOGY IN TWENTY-ONE PATIENTS

Cause of Obstruction	No. of Patients
I. Benign	17
Idiopathic thrombosis or chronic mediastinitis	8
Organized hematoma	1
Postradiation fibrosis	2
Granuloma or tuberculosis	2
Other	4
II. Malignant	4

TABLE II
SUMMARY OF TYPES OF GRAFTS IN TWENTY-ONE PATIENTS

Type of Graft	No. of Patients
Arterial homograft (preserved)	10
Arterial heterograft (preserved)	1
Vein autograft	7
Prostheses (crimped nylon)	1
No graft used	2

TABLE II
SUMMARY OF SITES OF SHUNT TO HEART IN TWENTY-ONE PATIENTS

Site of Shunt to Heart	No. of Patients
I. Right auricular appendage	10
II. Superior vena cava	8
III. Other:	
Thrombectomy	1
Azygos vein to right auricular appendage	1
Venous autograft of azygos vein to right auricular appendage	1

pressures did not return to normal levels but remained slightly to moderately elevated in most of the patients. Some of the grafts were thought to have become obstructed after several months. In these cases the symptomatic improvement has been maintained, suggesting that an adequate collateral circulation and possibly some degree of recanalization have developed. A median sternal-splitting incision affords good exposure for the insertion of the graft.

CONCLUSION

More experience is necessary before an adequate evaluation of the grafts and shunts can be made. It is hoped that long-term follow-ups or the autopsy findings of the twenty-one cases presented may be available at a future date. The clinical results to date appear to be comparable to the results obtained from comparable procedures done in the experimental laboratory. At the present time the optimal treatment of superior caval obstruction, not due to a malignant neoplasm but to a benign fibrotic process, is the insertion of a homograft between the proximal patent caval or innominate veins and the intrapericardial superior vena cava, if patent, or the right auricle.

REFERENCES

1. Hunter, W. The history of an aneurysm of the aorta with some remarks on aneurysms in general. *M. Observations & Inquiries, London*, 1: 323–357, 1752.
2. Fischer, J. Über Verengerung und Verschliesgung der Vena Cava Superior. Inaugural Dissertation, Halle, 1904.
3. Ochsner, A. and Dixon, J. Superior vena caval thrombosis. *J. Thoracic Surg.*, 5: 641–672, 1936.
4. McIntire, F. and Sykes, E. Obstruction of the superior vena cava: a review of the literature and report of two personal cases. *Ann. Int. Med.*, 30: 935–960, 1949.
5. Veal, J. and Cotsonas, N. Diseases of the superior vena caval system with special consideration of pathology and diagnosis. *Surgery*, 31: 1–12, 1952.
6. Carlson, H. Obstruction of the superior vena cava: an experimental study. *Arch. Surg.*, 29: 669–677, 1934.
7. Gerbode, F., Yee, J. and Rundle, F. Experimental anastomosis of vessels to the heart. *Surgery*, 25: 556–565, 1949.
8. Samson, P., O'Neill, T., Kay, E., Hanlon, R., Klassen, K., Deterling, R., Gerbode, F. and Holman, E. Discussion on Scannell, J. *J. Thoracic Surg.*, 28: 163–174, 1954.
9. Ashburn, F., Sewell, W. and Huggins, C. Experimental replacement of the superior vena cava with homologous arteries, and report of a case with malignant obstruction replaced with a heterologous artery. *J. Thoracic Surg.*, 31: 618–624, 1956.
10. Richards, V. and Smith, R. A. To be published.
11. Egdahl, R., Hume, D. and Schlang, H. Plastic Venous Prostheses. Surgical Forum, 1954, p. 235. Philadelphia, 1955. W. B. Saunders Co.
12. Pilcher, L. and Overholt, R. Venous obstruction in the upper mediastinum. *Ann. Surg.*, 6: 74–86, 1934.
13. Hinshaw, H. and Rutledge, D. Lesions in the superior mediastinum which interfere with venous circulation. *J. Lab. & Clin. Med.*, 27: 908–916, 1942.
14. Hallett, C. Collateral circulation in cases of obstruction to the vena cava. *Edinburgh M. & S. J.*, 69: 269, 1848.
15. Ehrlich, W., Ballon, H. and Graham, E. Superior vena caval obstruction with a consideration of the possible relief of symptoms by mediastinal decompression. *J. Thoracic Surg.*, 3: 352–364, 1933.
16. Gray, H. and Skinner, I. Constrictive occlusion of the superior vena cava. *Surg., Gynec. & Obst.*, 72: 923–929, 1941.
17. Favre, R. Obliteration of superior vena cava. *Rev. méd. de la Suisse Rom.*, 39: 97, 1918.
18. Chiray, M. and Semelaique, S. Compression of superior vena cava by aneurysm. *Bull. et mém. Soc. méd. d. hôp. de Paris*, 46: 13, 1922.
19. Waterfield, R. Biot respiration in superior vena caval obstruction. *Guy's Hosp. Rep.*, 78: 305, 1928.
20. Guleke, N. Über dil entolostende mediastinotomie. *Chirurg.*, 1: 455–459, 1929.

Carcinoma of the Cervical Stump

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DESPITE the low mortality and morbidity of total hysterectomy today, the incidence of carcinoma of the cervical stump following supracervical or subtotal hysterectomy remains practically unchanged from ten to fifteen years ago.

From the average figures given by cancer clinics [1–3] in the United States, 6 to 8 per cent of all cervical cancers occur in cervices that the gynecologist or general surgeon had failed to remove at the original operation when hysterectomy had been indicated and performed.

With the increasing emphasis on detection of pelvic cancer and the routine periodic pelvic examination, it is surprising to find a greater than suspected incidence of cervical stumps remaining in patients who had undergone previous "hysterectomy." It is unwise to accept any patient's assertion that her "female organs" have been removed without making an adequate examination. Many patients are unaware that a part of their uterus still remains. They have not been informed by their physician of the limits of their previous operation, nor have they been instructed that in these instances the cervix must be examined often and for the rest of their lives if it is not removed.

The indictments of omission and commission fall heavily on the surgeon of today who fails to perform total hysterectomy when hysterectomy is indicated, or in the very rare instances when supracervical hysterectomy is necessary, to instruct his patient adequately and thoroughly as to the necessity of observation and follow-up periodic examination for the rest of her life.

The possibilities of disease developing in the cervix after this operation become apparent when carcinoma is found at a later time.

Since the first publication of Alterthum in 1895 [4] on malignant lesions of the cervical stump, reports have been made from time to time on the problems involved in the management of the cervical stump. These center mainly on the prevention of malignant and benign diseases, and their early diagnosis and treatment.

The purpose of this presentation is to discuss some additional approaches to the problems of the cervical stump. They are made from an analysis of patients with cervical stump who have been examined and treated at the University Hospital.

Incidence. From January 1, 1940, to January, 1958, eighty-two patients with cancer of the cervical stump have been seen on the gynecology services of the University Hospital. During this same time the total number of cervical cancers treated was 1,027. This gives a percentage of 7.98 for the incidence of carcinoma of the cervical stump in all cervical cancer, and corresponds to Creadick's figure of 8.66 per cent from Duke University [5].

Of these eighty-two cases, fifty-eight (or 70.7 per cent) were "true" cases and twenty-four (or 29.3 per cent) were "coincident" cases of carcinoma of the cervical stump. The "coincident" cases are defined as those in which the diagnosis was made within two years from the time of supracervical hysterectomy and it is interpreted that cancer existed at the time of the original operation. If the malignant lesion was manifested after that time, it is listed as a "true" case and is presumed to have developed after the operation.

Thus in nearly one-third of the cases seen or referred to us in which the diagnosis of cervical stump carcinoma was established, the malignancy was present when the operation was performed. It further means that almost one-third of these operations would never have been performed had the surgeon made the proper and correct diagnosis or diagnoses before proceeding with the initial surgical procedure.

Negligence, either in the form of no vaginal examination, the non-performance of the cytologic smear or inadequate biopsy of the cervix before hysterectomy, thus becomes one of the major problems of carcinoma of the cervical stump and an important cause of its ineffectual management.

TABLE I
AGE INCIDENCE OF CERVICAL STUMP CARCINOMA AT THE TIME OF DIAGNOSIS

Age (yr.)	No. of Patients
30–39	10
40–49	24
50–59	29
60–69	10
70–79	9

Distribution of Age. The ages of the eighty-two patients analyzed ranged from thirty-two to seventy-eight years, with the average fifty-two. This corresponds closely with the 945 cases of carcinoma of the cervix (53.3). As can be seen, the majority occurred in patients between the ages of forty and sixty years. (Table I.) The average length of time from the supravaginal hysterectomy to the diagnosis of carcinoma ranged from thirty-six years to zero years, with the average 13.8 years. This includes both the "true" and "coincident" cases.

TABLE II

No. of Pregnancies	No. of Patients
0	30
1	19
2	13
3	6
4	6
5	4
6	0
7	3
8	1

Parity. Thirty patients of the eighty-two with carcinoma of the cervical stump (36.6 per cent) had never been pregnant. This large number of nulliparous patients is surprising, as parity has seemed to have more than a casual relationship to cervical carcinoma. The parity of the entire group of eighty-two patients is shown in Table II with distribution by number of pregnancies. The age at which the nulliparous patients had their supravaginal hysterectomy performed varied from eighteen to fifty-two years. (Table III.) Ten of the thirty nulliparous patients had undergone subtotal hysterectomy before the age of thirty. This number may help in part to explain the low fertility of the entire group but leaves unexplained the indications for the subtotal hysterectomy in this age group. The age of the entire group of patients at the time of their hysterectomy is shown in Figure 1.

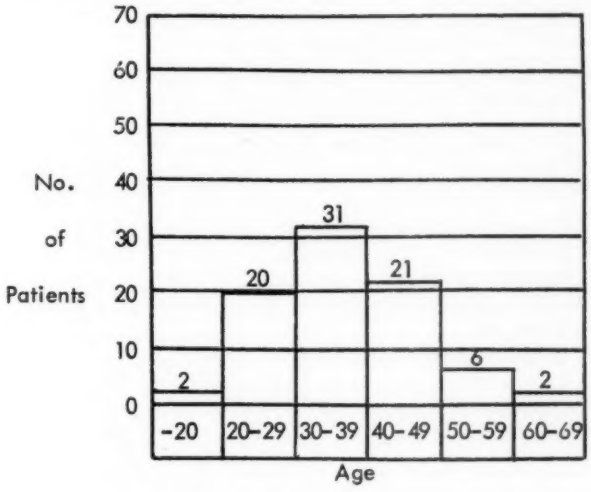

FIG. 1.

TABLE III
AGE OF NULLIPAROUS PATIENTS AT THE TIME OF SUBTOTAL HYSTERECTOMY

Age (yr.)	No. of Patients
18–19	2
20–29	9
30–39	11
40–49	5
50–59	3

Pathology of Subtotal Hysterectomy. The majority of the subtotal hysterectomies were performed for uterine fibroids, but no complete analysis of these indications is possible. A number of the patients did not know or had not been informed of the disease process that was present when the surgeon performed the operation!

The indications for the previous subtotal hysterectomies were difficult to obtain, either

from inadequate case histories in our own hospital or in other hospitals where the previous surgery was performed. In those instances questioning of the patient elicited the response of "tumors" or "bleeding" as the major reasons for the removal of the uterus. In only one-half (forty-one) of the cases could a previous indication be found, and some of these are quite inadequate and the indications questionable. They are presented in Table IV only to show these defects. The fact that half of the patients did not know or remember the cause for the removal of the uterus clearly demonstrated physician dereliction in informing the patient why the operation was performed.

TABLE IV
THE INDICATIONS FOR SUBTOTAL HYSTERECTOMY

Reason for Hysterectomy	No. of Patients
Fibromyomas	17
"Tumors" (fibromyomas)	10
Menometrorrhagia	7
Pelvic inflammatory disease	2
Pelvic pain	1
"Habitual abortion"	1
Malignancy of the uterus	2
Dysmenorrhea	1
Unknown	41

Clinical Classification. At the time of the initial admission to the Gynecological Tumor Clinic, clinical classification of the extent of carcinoma of the stump was made. (Table V.) The staging is based on the International Classification.

Over one-half (forty-nine) of the classified stages fall in stages II and III, showing the degree to which the cancer had progressed beyond the limits of the cervix by the time the patients had made their initial visit to the Clinic. Only five of the stage III patients have survived, three of them for five years or more. Each of these three is living with disease and complicated by rectovaginal fistula in the first, colostomy and chordotomy in the second, and rectovaginal fistula in the third. Only one of the eleven stage IV patients is living four years after treatment and with disease, complicated by colostomy and chordotomy. The total five-year survival rate for the eighty-two patients is 35 per cent.

TABLE V
CLINICAL CLASSIFICATION—CARCINOMA OF THE CERVICAL STUMP

Stage	No. of Patients
I	21
II	24
III	27
IV	11

Therapy Given in Eighty-two Cases of Carcinoma of the Cervical Stump. The therapy given to the eighty-two patients was basically radiation. This consisted of either radium or radioactive cobalt intravaginally, usually followed by external radiation. Several patients received radioactive cobalt needles intracervically. In the past few years selected pa-

TABLE VI
THERAPY OF CERVICAL STUMP CARCINOMA

Therapy	"True" Cases	Living	Dead	"Coincident" Cases	Living	Dead
Radium alone	4	2	2	3	1	2
Co^{60} alone	4	3	1	2	1	1
X-ray alone	2	1	1	0	0	0
Radium or cobalt and x-ray	39	12	27	12	3	9
Cobalt needles and x-ray	1	0	1	3	2	1
Cobalt needles alone	1	1	0	0	0	0
Radium, surgery and x-ray	2	2	0	0	0	0
Cobalt, surgery and x-ray	6	5	1	3	2	1
Totals	59	26	33	23	9	14

tients have received intravaginal radioactive cobalt, followed by radical cervicectomy and bilateral pelvic lymph node excision. The types of therapy and results are given in Tables VI and VII. Dosages of roentgens are not given because of the variability over the past eighteen

TABLE VII
RESULTS OF TREATMENT

Treated cases of carcinoma of cervical stump..	82
Five-year survival rate (11 of 40 patients)....	27.5%
Total patients, cervical cancer treated.....	1,027
Cervical cancer with fundus.....	945
Five-year survival rate—with fundus.....	39.1%

years, but average intravaginal applications approximated 4,000 to 6,000 r when given alone or with external therapy. X-ray therapy consisted of 3,000 to 4,000 r to four parts. At one time (1949 to 1953) external therapy had been raised to approximately 6,000 r, but bowel complications increased proportionately and this was abandoned.

COMMENTS

The initial answer to the prevention of cervical stump carcinoma is total hysterectomy. With this no one will disagree. When hysterectomy is indicated, the procedure must be total hysterectomy. Only in the rarest of instances should the subtotal operation be performed. Those exceptional patients should later have cervicectomy or wide conization or be followed up their remaining lives with cytological, visual and palpable pelvic examination.

The problems of carcinoma of the cervical stump go deeper than this dictum alone. The first problem to be solved is education. This education must be directed particularly to the physician who operates upon patients when hysterectomy is indicated. The education of the merits of total hysterectomy over the subtotal hysterectomy must be initiated with our medical students, then must be given to the interns, residents, and finally the general practitioners and specialists.

Most gynecological and surgical clinics in this country today are the leaders in advancing total hysterectomy over subtotal hysterectomy and little contention may be made there. The majority of subtotal hysterectomies being performed is either in smaller hospitals where hysterectomy may abound in the hands of the unexperienced general surgeon or gynecologist or in the larger hospitals where gynecology has been submerged in the subspecialty strata with little or no inspiration to develop highly trained qualified technicians of the female pelvis.

Second, just as pressing as the problem of

TABLE VIII
HYSTERECTOMIES PERFORMED FROM 1940 TO 1958 IN THE DEPARTMENT OF OBSTETRICS AND GYNECOLOGY, THE OHIO STATE UNIVERSITY

Total abdominal hysterectomies.....	1,866*
Supracervical (subtotal).....	21
No supracervical hysterectomies performed in 1955, 1956 and 1957.	

* This number does not include Wertheim or vaginal hysterectomies.

education of these groups is the management of the cervical stump once the subtotal hysterectomy has been performed. It is here that the gynecologist or surgeon trained in gynecology can assume the role of leadership in the prevention of later cancer developing in the cervical stump.

The management of benign diseases of the cervical (or cancer-free) stumps is cervicectomy whenever possible. If they are not removed, biopsy and conization of each cervix should be done, followed by periodic observation and Papanicolaou cytological smear. An indication of the program to reduce carcinoma of the cervical stump by the Department of Obstetrics and Gynecology may be illustrated when our operative records show 242 cervicectomies performed from 1940 to 1958. Obviously many of these patients were referred to our Department, and we have had the opportunity to operate on this large number to eradicate benign cervical disease and in the prevention of cancer of the stump.

The disease-free cervical stump likewise demands constant supervision on the part of the physician. His duty to his patient is clear to inform her she must be watched and examined periodically the rest of her life with visual, cytologic and manual examinations. Negligence in the performance of the cytologic smear or adequate biopsy of an abnormal cervix is a major cause of the ineffectual management in carcinoma of the cervical stump.

Last, hysterectomy should never be performed until the cervix has been adequately studied prior to the surgical procedure. This

must include routine cytologic study of the cervix, dilatation and curettage of the uterus and often biopsy or cold knife conization. Total hysterectomy should always be the choice of operation. Our attitude in the Department of Obstetrics and Gynecology is clearly shown in Table VIII.

SUMMARY

When hysterectomy is indicated, the only operation indicated is total hysterectomy. This method offers the only absolute way to eradicate carcinoma of the cervical stump. The safety of total hysterectomy today no longer gives a freedom of choice between the total and subtotal operations. During the past three years there were no operative deaths in the 1,866 cases in which total hysterectomy was performed. Other gynecologic clinics report similar low mortality and morbidity rates in total hysterectomy.

A rigid program of education must be initiated and continued to all physicians as to the inherent dangers of the remaining cervical stump.

Better physician-patient relationship is needed to inform the patients who had the incomplete operation that a potential hazard of malignancy remains and that steps must be taken to remove any disease present or to examine the cervix carefully and periodically during her life.

A study is made of the eighty-two cases of carcinoma of the cervical stump that have come under the care of the Department of Obstetrics and Gynecology from 1940 to 1958. This shows age of development of cancer of the stump, methods of treatment and survival figures.

Increased emphasis must be placed on periodic examination, cytologic and biopsy studies of the cervical stump, and operation when indicated.

In all patients upon whom hysterectomy is to be performed, a thorough study of the cervix by cytological and biopsy methods and the routine dilatation and curettage of the fundus and cervical canal must be done.

In no other area of surgery is cancer so easily prevented by performing an operation for a diseased organ by removing it completely.

REFERENCES

1. Thornton, W. N., Jr., Claiborne, H. A., Jr. and Jones, H. C. The problem of the cervical stump. *South. M. J.*, 49: 376, 1956.
2. Dodds, J. R. and Lexour, J. P. Carcinoma of the cervical stump. *Am. J. Obst. & Gynec.*, 69: 252, 1955.
3. Hahn, G. A. Carcinoma of the cervical stump with special reference to the causes of delay in treatment; observations from data of the Philadelphia Committee for the Study of Pelvic Carcinoma. *Am. J. Obst. & Gynec.*, 71: 421, 1956.
4. Decker, D. G., Hunt, A. B., Fricke, R. E. and Nelson, G. A. Carcinoma of the cervical stump. *Am. J. Obst. & Gynec.*, 73: 981, 1957.
5. Creadick, R. Carcinoma of the cervical stump. Read at the meeting of the American Association of Obstetricians and Gynecologists, Sept. 6, 1957. Hot Springs, Va. (To be published.)
6. Caulk, R. M. Transvaginal roentgen therapy in cancer of the cervical stump. *Am. J. Roentgenol.*, 72: 469, 1954.
7. Irwin, R. W. Carcinoma in the cervical stump. *Canad. M. A. J.*, 70: 561, 1954.
8. Kelly, A. J. and Brawner, D. L. Experience of the Savannah Tumor Clinic in carcinoma of the stump of the cervix. *Am. J. Obst. & Gynec.*, 66: 711, 1953.
9. Young, H. A. and Jonas, A. F. Combined surgery and irradiation in the treatment of carcinoma of the cervical stump. *Surg., Gynec. & Obst.*, 96: 288, 1953.
10. Tice, G. M. Treatment of cervical stump carcinoma. *J. Kansas M. Soc.*, 54: 98, 1953.
11. di Paola, G. and Vasquez Ferro, E. Cancer of the cervical stump. *Prensa méd. argent.*, 41: 1660, 1954.
12. Turtala, V. Carcinoma of the cervical stump. *Ann. chir. et gynaec. Fenniae*, 42: 101, 1953.

Elective Operations Performed for Duodenal Ulcer, with Their Mortality

RESULTS OF A SURVEY IN SELECTED OHIO HOSPITALS BY THE SURVEY COMMITTEE, OHIO CHAPTER, AMERICAN COLLEGE OF SURGEONS*

From the Department of General Surgery, The Cleveland Clinic Foundation, and The Frank E. Bunts Educational Institute, Cleveland, Ohio. *From a paper presented at the Second Annual Meeting of the Ohio Chapter, American College of Surgeons, Toledo, Ohio, September 6, 1957.*

A SURVEY sponsored by the Ohio Chapter of the American College of Surgeons, had four objectives: (1) To determine what operations Ohio surgeons are using electively for chronic duodenal ulcer; (2) to determine what the mortality is for these operations; (3) to determine, if possible, the formal qualifications of the surgeons performing these operations; and (4) to find out what procedures are being utilized in acute perforation of duodenal ulcer, and the mortality.

METHODS OF STUDY

Data were obtained from forty-two investigators (see footnote) reporting from twenty-nine hospitals in fifteen Ohio communities, as shown in Figure 1. The hospitals range in size from 147 to 842 beds and are situated in communities ranging in population from 15,000 to 1 million people. They are both open and closed staff hospitals, and include N.P.A. (Non-Profit Association), church, and university hospitals. The investigators obtained a consecutive series of patients, either from the hospital operating room record book or some equally reliable source, starting in 1957 and working backward until they either compiled 100 cases or reached the beginning of 1950, whichever occurred first. One hospital took its series back to 1947 but the other hospitals reported operations only since 1950; more than half of the operations were performed in the five-year period from 1952 through 1957. The sizes of the series of elective operations ranged from forty-one to 114 patients; fifteen hospitals reported on 100 or more cases. The series

FIG. 1.

* Members of the Committee are: S. O. Hoerr, M.D., Chairman; R. M. Bartlett, M.D., J. L. Bilton, M.D., C. Boeckman, M.D., R. Brown, M.D., G. Crile, Jr., M.D., W. M. Dowlin, M.D., J. C. Drake, M.D., H. B. Elliott, M.D., E. H. Ellison, M.D., P. T. Evangelista, M.D., S. O. Freedlander, M.D., R. D. Handy, Jr., M.D., H. L. Hauman, M.D., E. F. Jones, M.D., K. L. Kaminski, M.D., J. H. Lazzari, M.D., R. W. Lewis, M.D., M. F. Lieber, M.D., C. G. Lovingood, M.D., C. R. Lulenski, M.D., C. W. McNamara, M.D., J. R. Mack, M.D., M. Meftah, M.D., W. F. Montanus, M.D., W. B. Morrison, M.D., W. A. Neill, M.D., S. W. Northrup, M.D., M. A. Orozco, M.D., H. Pescovitz, M.D., P. J. Robechek, M.D., F. L. Shively, Jr., M.D., P. W. Smith, M.D., R. C. Smith, Jr., M.D., R. Smythe, M.D., J. R. Stevens, M.D., M. B. Taliak, M.D., N. W. Thiessen, M.D., E. C. Weckesser, M.D., H. C. White, M.D., A. E. Winston, M.D., and R. W. Zollinger, M.D.

of perforated ulcers varied from six to sixty-one patients in the twenty-seven hospitals reporting; the median was twenty-six patients.

ELECTIVE OPERATIONS

Rigidly excluded from the study were such conditions as gastric ulcer, jejunal ulcer and

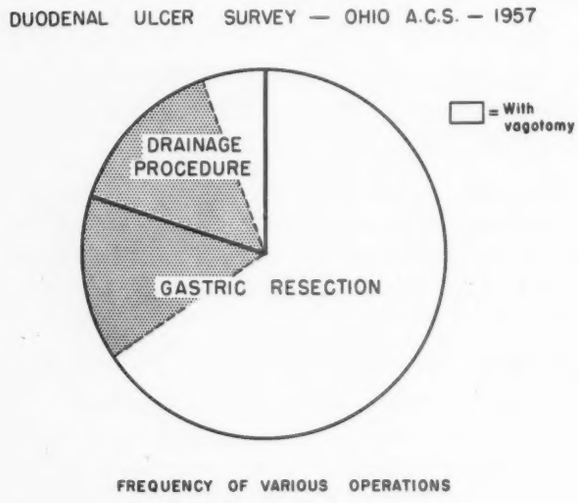

FIG. 2.

hypertrophic pyloric stenosis. Also excluded from the study on elective operations were any emergency or urgent procedures such as those performed for continuing hemorrhage or acute perforation. An operative fatality was any death occurring within thirty days of operation.

Four hundred thirty-two surgeons performed 2,562 elective operations, of which there were 110 deaths or a mortality of 4.3 per cent. In this figure of 432 there is some unavoidable overlapping since a few surgeons may have operated in more than one participating hospital. It is believed that this overlapping does not involve a large number of surgeons. In nineteen hospitals in which the data were available, it was found that 23 per cent of the surgeons operating are not Board certified, are not Fellows of the American College of Surgeons, or are not residents in training. Those surgeons, who may be regarded as having no formal qualification, performed 11 per cent of the operations in those hospitals. Some of those surgeons without formal qualification were Board eligible.

Of twenty-three hospitals having data concerning the number of operations performed by individual surgeons, in each of nineteen there was at least one surgeon who performed only a single operation in the series. Fifty-one was the greatest number of operations performed by any one surgeon.

Type of Operation. The operations may be divided into two groups on the basis of those involving resection and those in which no resection was performed. In nearly all of the patients in the second group a drainage procedure was performed. (Fig. 2.) About 80 per cent of the patients had gastric resection. In about 30 per cent of all the procedures including both drainage procedures and resections, there were supplementary vagotomies. Whereas the over-all mortality for all procedures was 4.3 per cent, for resection it was 4.9 per cent and for drainage procedures it was 1.7 per cent. The range in mortality for individual hospitals varied from zero in two hospitals to a high of 7.8 per cent; nine hospitals had death rates of 6 per cent or greater and eleven hospitals had rates of 3 per cent or less. One of the two hospitals reporting no deaths was a small community hospital with a total series of forty-one cases.

Gastric Resection. In analyzing the type of resection performed, it was determined that a moderate resection removing between 50 per cent and 75 per cent of the stomach was by far the most popular, being performed in 65 per cent of all patients having resection and in about 50 per cent of all patients having elective operations. So-called radical resection (75 per cent or more of stomach resected) made up only 21 per cent of all resections and 16 per cent of all elective operations. The extent of the resection had very little effect on mortality (it was 4.6 per cent in radical resection); this is consistent with the general belief that the risk in gastric resection for duodenal ulcers lies in the treatment of the duodenal stump and hence would be independent of the amount of stomach removed. Although the Billroth I reconstruction was less often employed than the Billroth II reconstruction, it is somewhat surprising that it seemed to carry a significantly lesser mortality. For the Billroth I reconstruction the mortality was 2.8 per cent; for the Billroth II it was 5.1 per cent. It would seem incorrect to conclude that the Billroth I is a safer operation; a more likely explanation is that it was performed in easier cases in which a penetrating ulcer did not present a problem in mobilizing the duodenum.

In addition to the standard types, "tubular" resections in three patients and sleeve resec-

tions in fourteen patients were also included in the resection group.

Drainage Procedures. An analysis of the drainage procedures performed and the accompanying mortality are given in Table I. The statistical difference between anterior and posterior gastrojejunostomy is probably without significance but it is of interest that there appears to be a substantial swing toward the performance of the simpler anterior gastrojejunostomy. Pyloroplasty is not popular with Ohio surgeons as it was performed only twenty-eight times. Twelve of these twenty-eight pyloroplasties were reported from a single institution.

TABLE I
DRAINAGE PROCEDURES

Operation	No. of Cases	No. of Deaths	Per cent
Posterior gastrojejunostomy...	324	5	1.5
With vagotomy.....	241		
Without vagotomy.....	83		
Anterior gastrojejunostomy....	124	3	2.4
With vagotomy.....	79		
Without vagotomy.....	40		
Pyloroplasty (21 cases with vagotomy).....	28*	0	...
Heineke-Mikulicz.....	15		
Finney.....	13		

* Twelve cases from one hospital.

Vagotomy. Vagotomy accompanied only 18 per cent of all gastric resections. However, it was performed in 78 per cent of the small resections (less than 50 per cent of stomach resected) indicating the intent of surgeons to safeguard the patients against recurrent ulceration when large amounts of stomach are conserved. Similarly supplementary vagotomy was performed in more than 70 per cent of the drainage operations. (Fig. 1 and Table 1.) In all, in about one-third of the patients in the entire series of elective operations vagotomy was performed. Vagotomy as the sole surgical procedure was performed only four times; evidently Ohio surgeons agree with the current view that vagotomy should supplement some other procedure.

The Cause of Death in Elective Operations. In a little less than one-half of the 102 deaths for which data were furnished (Table II) the cause of death appeared to be directly related to the operation, and included such complications as peritonitis, hemorrhage, and shock. A little less than half the deaths were ascribed to complications not directly related to the operation itself, such as myocardial infarct and pneumonia. About 10 per cent of the deaths was due to such causes as acute hemorrhagic pancreatitis or enterocolitis, in which a clear relationship to the surgery is also difficult to establish. This same ratio held true for the few deaths following drainage procedures as well as resections.

TABLE II
CAUSES OF DEATH IN ELECTIVE OPERATIONS*

Cause of Death	No. of Patients	Per cent
Directly related to surgery (peritonitis, hemorrhage, obstruction, dehiscence).....	48	47+
"Intra-abdominal," no direct connection (pancreatitis, enterocolitis, etc.).....	9	8+
"Extra-abdominal" (embolism, myocardial infarction, etc.).....	45	45−

* One hundred two deaths specifically diagnosed; number of necropsies not known.

In analyzing possible factors (Table III), no relation could be shown between death rate and size of hospital, size of community, type of staff, or the proportion of operations performed by the unqualified surgeons or by residents in training. The data asked for did not show fatality rates for particular groups of surgeons, i.e., residents in training, Board certified, or those without formal qualifications. If these figures could be known they might show a difference favorable to the better qualified surgeon. In one hospital where the figures were available the chief surgeon pointed out that there were four deaths in twenty-seven operations performed by surgeons without formal qualifications, a mortality of 14.8 per cent, as opposed to three deaths in the remaining seventy-three operations performed by qualified surgeons, a 4.1 per cent mortality. A note from another hospital stated that residents in training performed only thirty-two of 111

operations but accounted for three of the four deaths.

In reviewing the various figures it would seem that the most likely explanation for a relatively high mortality is the intrinsic risk in gastric resection performed for duodenal ulcer.

TABLE III
POSSIBLE FACTORS IN MORTALITY (OVER-ALL MORTALITY 4.3 PER CENT)

Factor	No. of Hospitals	Per cent
Community population		
Less than 100,000	8	4.1
500,000 or more	13	4.5
Hospital		
250 beds or less	7	4.1
500 beds or more	10	4.8
"Closed staff" hospital	7	5.3
Operations with gastric resection, all cases		4.9
Operations without resection, all cases		1.7
Hospitals with 95 per cent or more of patients who had resection		5.4
Hospitals with 70 per cent or less of patients who had resection		4.1

This is already indicated in the comparison of the mortality in gastric resection, 4.9 per cent, with drainage operations, 1.7 per cent, and a little less strikingly in the comparison of the combined mortality in hospitals in which more than 95 per cent of the procedures performed were resections with the combined mortality in hospitals in which less than 70 per cent of the procedures were resections. In the first group of hospitals, in which surgeons evidently adhered to a policy of resection for every ulcer, there was a combined mortality of 5.4 per cent as opposed to a combined mortality of 4.1 per cent in the second group in which a more liberal attitude toward the performance of lesser procedures seemed to exist.

SURGICAL TREATMENT OF ACUTE PERFORATION

Table IV gives the results in acute perforation of duodenal ulcer and shows clearly that Ohio surgeons believe in simple closure as the treatment of choice. A note from one investigator states that the only two resections for acute perforation recorded for his hospital were performed by general practitioners and both patients died. Since this accounted for two of the four deaths from resections one might conclude that resection for acute perforation was being employed with considerable selectivity and apparently with reasonable success in the average institution with qualified surgeons.

TABLE IV
ACUTE PERFORATION OF DUODENAL ULCER

Treatment	No. of Cases	No. of Deaths	Per cent
Simple closure	690	27	3.9
Gastric resection*	24	4	16.5
Other procedures	16	1	6.2
Total	730	32	4.4

* Resection in 3 per cent of the cases.

SUMMARY AND CONCLUSIONS

1. According to the foregoing survey, Ohio surgeons prefer the moderate gastric resection (50 to 75 per cent of the stomach removed), as the elective operation for chronic duodenal ulcer.

2. There were 110 deaths among the 2,562 patients having elective operations for chronic duodenal ulcer, a mortality of 4.3 per cent.

3. Of the 2,562 patients, 80 per cent had some type of resection, including 17 per cent who had accompanying vagotomy; the mortality in this group was 4.9 per cent.

4. Of the 20 per cent who had a drainage operation such as gastrojejunostomy or pyloroplasty, the mortality was 1.7 per cent. Seventy per cent of these patients had supplementary vagotomy.

5. Twenty-three per cent of the 432 surgeons taking part in the operations were not certified by the American Board of Surgery, were not Fellows of the American College of Surgeons, or were not residents in training; they performed 11 per cent of the operations in the series.

6. In analyzing the reasons for a high mortality, the most likely cause seemed to be the intrinsic risk in performing gastric resection for duodenal ulcer.

Surgical Management of Duodenal Ulcer in Community Hospitals

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OVER the years many surgical procedures have been employed in the treatment of duodenal ulcer and numerous reports are available in the literature describing their faults and virtues. At times one institution has employed a single procedure almost to the exclusion of others and later abruptly changed to another mode of attack. The question of the best surgical approach to duodenal ulcer is not yet settled and many centers are employing several operative procedures and their combinations.

Although the operations performed for duodenal ulcer at the larger medical centers are on record, little is known about their acceptance outside of these institutions. Furthermore, the mortality statistics from these centers have been challenged as not a true indication of the postoperative fatalities over the country in the treatment of this disease since few comparable reports are available from community hospitals. In an effort to shed some light upon this subject, the operations performed for this disease in four hospitals of 250 or more bed capacity located in two cities a considerable distance from each other, were reviewed. The various procedures were carried out by fifty-five surgeons engaged in private practice and there was no set hospital policy for the treatment of the disease in any of the hospitals studied. The periods under study in three of the hospitals were from 1952 to 1957, and from 1949 to 1957 in the fourth. Cases of acute perforation of duodenal ulcer were not included in this series which is comprised of 332 cases. This series does include emergency operations performed for hemorrhage.

As shown in Table 1, subtotal gastric resection was the operation performed in 302 cases, comprising 91 per cent of the series. Gastroenterostomy was used in twenty cases (6 per cent of the series) and was employed for the most part in elderly patients and in those with obstruction as the only complication. The

TABLE 1

Procedure	Indication			
	Hemorrhage	Intractability	Obstruction	Total
Subtotal gastric resection	86	147	67	300
Gastric resection and vagotomy	0	2	0	2
Billroth 1	0	2	0	2
Billroth 1 and vagotomy	0	1	0	1
Gastroenterostomy	2	4	14	20
Gastroenterostomy and vagotomy	0	1	0	1
Hemigastrectomy	2	1	0	3
Hemigastrectomy and vagotomy	2	0	1	3
				332

average ages of people undergoing subtotal gastric resection and gastroenterostomy were forty-eight and sixty years, respectively. Vagotomy combined with gastroenterostomy or resection was very little favored, being performed in only seven cases (2 per cent of the series).

TABLE II

Indication	No. of Cases	Per cent
Hemorrhage	92	28
Obstruction	82	25
Intractability	158	47

Table II shows the reason for advising surgical treatment for duodenal ulcer and almost half of the cases were found to fall in the great reservoir of intractability. In this category there is wide variance as to the length and type of medical supervision. Hemorrhage and obstruction each made up roughly a fourth of the series.

There were eighteen deaths (Table III), a mortality of 5.4 per cent. The mortality rate of 10 per cent in gastroenterostomy is reflected by the larger number of poor risk patients in that group. The death of the only patient having a gastroenterostomy and vagotomy is not to be construed as a reflection upon that operation. The causes of death listed in Table IV do not in all cases represent the immediate complication leading to death. There were several instances in which wound disruption or leakage of the duodenal stump was considered the precipitating factor leading to the peritonitis, lower nephron nephrosis, or cerebral accident which was the immediate cause of death. There was one case of generalized peritonitis for which no cause was found at autopsy.

Fifty-four per cent of the operations were performed by Board qualified surgeons and thirty-eight per cent by Fellows of the American College of Surgeons, although not Board certified. Eight per cent of the cases were patients operated upon by surgeons having neither qualification. The mortality rate of Board qualified and College approved men was 4.5 and 4.7 per cent, respectively. There was a sharp rise to 14.8 per cent in the mortality of those patients operated upon by men having neither of these two qualifications.

COMMENTS

It would appear in the four community hospitals studied that subtotal gastric resection was the most favored operation for duodenal ulcer since it comprised 91 per cent of the operative procedures. This figure is quite high compared to the policies of other institutions reporting in the literature. At the Mayo Clinic [1], the choice of subtotal gastric resection in the treatment of chronic duodenal ulcer ranged from 75.7 per cent in 1948 to 86.7 per cent in 1954. Johnson et al [2], reported gastric resection used in only 64 per cent of the operations for this condition at the New York Hospital–Cornell Medical Center in a review of 151 patients under the age of thirty-five.

The tendency in this series to employ this more extensive procedure in all probability had much to do with the mortality rate of 5.4 per cent, which is comparable to that of some reports in the literature but considerably higher than others. Rauch [3] of the University of Minnesota, reported a mortality of 4.7 per

TABLE III

Procedure	Hospital Deaths	No. of Operations	Mortality (%)
Gastric resection	15	300	5
Gastric resection and vagotomy	0	2	0
Billroth 1	0	2	0
Billroth 1 and vagotomy	0	1	0
Gastroenterostomy	2	20	10
Gastroenterostomy and vagotomy	1	1	100
Hemigastrectomy	0	3	0
Hemigastrectomy and vagotomy	0	3	0
Total	18	332	5.4

TABLE IV

Causes of Death	No. of Cases
Wound disruption	4
Duodenal stump leakage	4
Coronary thrombosis	2
Operative trauma to bile or pancreatic ducts	2
Peritonitis	1
Obstructed stoma	1
Perforation of small bowel	1
Cardiac arrest	1
Pneumonia, ileus	1
Undetermined	1

cent, although this had been reduced to 2.7 per cent in the later years of the report. In a review of 3,747 cases of duodenal ulcer treated surgically in Veterans Administration Hospitals, Gutman [4] found a mortality of 2.82 per cent. Babson [5] reported a mortality rate of 4.8 per cent in a community hospital in New England. At the Mayo Clinic [1], the yearly mortality rates from 1951 to 1955, have varied from 0.7 to 2.5 per cent.

It is entirely possible that a series of cases from a community hospital would contain a larger number of poor risk patients than would one from the larger medical centers due to the hazards of transportation of the desperately ill and for financial reasons. This factor would be particularly true in instances of hemorrhage and to a lesser extent in obstruction, and might to a certain extent contribute to the mortality figures. This, if found to be true, would be even more reason for greater diversification of operative procedures for duodenal ulcers performed in community hospitals, resulting in the selection of operations of less magnitude in the poor risk patient. Surgeons at times tend to overlook the patient's life expectancy in selecting gastric resection over a lesser procedure because of some long term drawbacks of the latter.

Of the eighteen deaths in this series thirteen would appear to be avoidable whereas the other five were unavoidable. It was somewhat surprising to find that four of the deaths resulted as a consequence of wound disruption. The incisions were secondarily closed successfully but death resulted from subsequent complications such as lower nephron nephrosis, pneumonia or cardiovascular accidents. Leakage at the site of closure of the duodenal stump was the cause of death in four cases and operative trauma to the bile or pancreatic ducts was the cause in two others. These complications occurred for the most part in the early part of the series. However, duodenal stump leakage has been a serious problem in most reports. Fifteen of sixty-five deaths following surgery for duodenal ulcer were caused by this complication in Gutman's series in Veteran's Administration Hospitals and in seven of nineteen deaths reported by Thompson and Stewart [6] at the Roosevelt Hospital. Here again, procedures of lesser magnitude such as gastroenterostomy with or without vagotomy, or an exclusion operation might have prevented a fatality.

SUMMARY

1. Three hundred thirty-two cases of duodenal ulcer treated surgically in four community hospitals are reviewed.

2. Compared to statistics from medical centers, the findings in this series show the employment of subtotal gastric resection in an unusually high percentages of cases.

3. The use of operations of lesser magnitude in the poor risk patient and in those patients in whom removal of the ulcer is fraught with considerable technical difficulty should result in a lowered mortality in the surgical management of this disease in a community hospital.

REFERENCES

1. Proceedings of the Staff Meetings of the Mayo Clinic, vol. 24–32.
2. Johnson, G., Jr., Sleisenger, M. H., Beal, J. M. Surgical treatment of duodenal ulcer in the young adult. *Ann. Surg.*, 146: 970–975, 1957.
3. Rauch, R. F. An evaluation of gastric resection for peptic ulcer. *Surgery*, 32: 638–653, 1952.
4. Gutman, P. E. A review of causes of death in 3,747 subtotal gastric resections for peptic ulcer. *Am. J. Surg.*, 87: 902–904, 1954.
5. Babson, W. W. Gastrectomy in a community hospital. *New England J. Med.*, 249: 1101–1105, 1953.
6. Thompson, J. E. and Stewart, C. F. Gastrectomy in peptic ulcer. *Ann. Surg.*, 139: 721–730, 1954.

Prescalene Lymph Node Biopsies

A REPORT OF 142 CASES

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IN many patients with intrathoracic disease, a diagnosis can not be established without exploratory thoracotomy. A significant morbidity and mortality may be expected from such a procedure for certain patients either because of debilitation or associated disease.

Since the original report of the technic and rationale of prescalene lymph node biopsies of Daniels [1] in 1949, the usefulness of this simple procedure has been widely appreciated because the information obtained may provide a diagnosis which makes thoracotomy unnecessary. In some clinics it has become part of the routine evaluation of patients suspected of having bronchogenic carcinoma. In addition to providing purely diagnostic information, it may determine the operability of patients with intrathoracic malignancy since we believe that thoracotomy should not be performed in the presence of metastatic malignancy in the prescalene nodes.

The anatomic basis of prescalene lymph node biopsies is based on the fact that the lymph nodes which lie in the fat pad anterior to the scalenus anticus muscle are in continuity with the drainage pathway of lymph from the mediastinum. It has been shown by Rouvierè [2] that the lymphatic drainage of the right lung and the right side of the mediastinum is via the right scalene lymph nodes and the right lymphatic duct into the systemic circulation. The drainage from the left lung is more complex. The lower left lung field (i.e. the basilar segments of the lower left lobe) also drains via the right lymphatic system while the apical segments of the upper left lobe drain via the lymphatic pathways of the left supraclavicular region. The left mid-lung field which includes the inferior part of the upper left lobe and the superior part of the lower left lobe was found to be drained via either side of the lymphatic system. In a real sense then, biopsy of the prescalene lymph nodes can evidence extension of disease processes which involve the mediastinal lymph nodes and a diagnosis of intrathoracic disease may be made without entering the thorax.

The clinical significance of prescalene lymph node biopsies has been reported and Table 1 tabulates the results of some of the larger series of patients that have been published. Weiss et al. [3], Johnson and McCurdy [4], England [5], and Storey and Reynolds [6] have also reported smaller series of cases. The value of the prescalene biopsy in pulmonary inflammatory disease was demonstrated by Carstensen et al. [7] and the significance in the differential diagnosis of pulmonary calcifications has been well documented by Johnson [8].

The data in Table 1 show a wide discrepancy in the percentage of positive results reported. This may be partially due to the selection of patients for prescalene lymph node biopsy. In all reports, a large variety of disease processes were diagnosed.

The technic of the operative procedure has been described by Foley et al. [9] and Connor [10] and will not be discussed herein. In this report, the efficacy of prescalene node biopsies is evaluated for use in a hospital in which the selection of patients is a matter of the clinical judgment of many attending physicians and is not a controlled study. We believe that an analysis of this type can present a more accurate evaluation of the expected clinical usefulness of this procedure.

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TABLE I

A COMPARISON OF THE RESULTS OF PRESCALENE LYMPH NODE BIOPSIES FROM PREVIOUSLY PUBLISHED REPORTS

Disease Process	Connor [10]	Shefts et al. [11]	Cuykendall [12]	Yang [13]	Piper [14]	Harken et al. [15]	Correll et al. [16]
Carcinoma of lung	9	13	....	9	10	31	7
Boeck's sarcoid	4	38	4	1	31	7	1
Lymphoma	1	4	1	3	4	3	2
Tuberculosis	....	8	....	3	3	2	1
Histoplasmosis or other fungus infection	....	1	....	....	3	.....	..
Metastatic disease of lung	....	3	3	8	1	.....	..
Anthracosilicosis	....	.....	....	1	.....	.....	..
Carcinoma of esophagus	....	.....	....	....	.....	2	..
Per cent of positive diagnoses	34.1	32.7	17.1	59.5	28.1	31.7	25
Total cases	41	205	41	42	185	142	44

The criteria used in this hospital for selection of cases for prescalene node biopsy are, in general, the following: (1) roentgenologic evidence of hilar and/or mediastinal enlargement not explained by the usual diagnostic procedures; (2) roentgenologic evidence of pulmonary infiltrates which appear to be either inflammatory or neoplastic; (3) determination of operability of selected patients with primary pulmonary neoplasms; and (4) to obtain lymph node tissue for either fungus or tuberculosis culture.

METHODS

The case histories of all patients included in this report were reviewed. No patients were included who had palpable lymphadenopathy present in the scalene or supraclavicular areas. In all instances, the diagnosis obtained from the tissue removed by prescalene lymph node biopsy was substantiated by other means or else the patient was included in a "questionable" disease category. Further substantiation included one or more of the following: (1) further cytologic evidence of the nature of the disease process either by surgical or bronchoscopic biopsy, or necropsy; (2) bacteriologic culture; (3) remission of the disease process after specific therapy; and (4) indisputable clinical evidence of a specific disease process.

All sections of nodes were routinely stained with hematoxylin and eosin and all those which showed evidence of a granulomatous reaction were stained with a modification of the Ziehl-Neelsen stain for acid fast organisms and with the Gridley stain for fungi.

The microscopic sections of all pathologic specimens were re-examined by one of us (H. T. E.) and the sections were correlated with all of the other pathologic material available from the same patient prior to or after the time of the prescalene biopsy. New sections were cut whenever it was necessary. The original diagnosis of the node biopsy was changed in three patients after review.

TABLE II

DISTRIBUTION OF PATIENTS BY SEX AND RACE (142 CASES)

	No. of Cases	Per cent
Females	44	31
Males	98	69
Negro	34	23.9
Caucasian	108	76.1

RESULTS

This study includes 142 patients who were operated upon during the interval of time from 1949 to June 1957. Ninety-eight or 69 per cent of the patients were males and forty-four or 31 per cent were females. (Table II.) The youngest was fourteen years old and the eldest eighty-one years old. Thirty-four or 23.9 per cent were Negro and 108 or 76.1 per cent

were Caucasian. In most instances the thesis of Rouvierè [2] was followed in determining the site of biopsy. In thirteen patients in whom the lesion was located in the left mid-lung field, a bilateral biopsy was performed. Of the remaining 129 patients, seventy-eight had biopsies of the right scalene area and fifty-one of the left. (Table III.)

TABLE III
DISTRIBUTION OF PATIENTS ACCORDING TO SIDE OF BIOPSY

Side	No. of Cases	Per cent
Right	78	54.9
Left	51	35.9
Bilateral	13	9.2
Total	142	100

In one group of patients, the study of succeeding developments in the case history showed that the disease process was of such a nature that it would not have been possible for a prescalene node biopsy to have produced positive results. These patients had clinical entities such as benign mediastinal cysts, unresolved pneumonitis other than of tuberculous or fungal etiology, and fibrotic disease of unknown etiology. We have elected to include these cases in a category called "not expected to be positive." Table IV shows the overall summation of the results of the biopsies. The patients who evidenced a positive correlation with the primary intrathoracic disease numbered sixty-five giving a percentage of positive results of 45.8. If the patients listed as "not expected to be positive" are excluded from the series, the percentage of positive results rises to 52.5.

We have attempted to correlate the size of the nodes removed at operation with the number of positive biopsies. (Table V.) The largest node found in each biopsy specimen was used in the tabulation of this data. The greatest number of positive correlations were found in nodes which were larger than 1.0 cm. in diameter. In those patients who had nodes greater than 1.1 cm. in diameter, over 88 per cent showed a positive correlation with the pulmonary pathologic condition. In no case included in this report were these nodes palpated at the physical examination performed on admission of the patient to the hospital. It was found that in only 15.4 per cent of the total positive biopsies was the node 0.5 cm. or smaller. The low incidence of positive results in nodes smaller than .5 cm. suggests that little is to be gained by prolonged operative exploration for minute nodes.

TABLE IV
RESULTS OF BIOPSY: DISTRIBUTION OF CASES IN TERMS OF CORRELATION WITH PRIMARY INTRATHORACIC DISEASE

	No. of Cases	Per cent	Per cent Excluding Those Cases Not Expected to be Positive
Positive	65	45.8	52.5
Negative	54	38.0	43.5
Not expected to be positive*	18	12.7	
Questionable†	5	3.5	4.0

* Refers to that group of patients in whom later evidence demonstrated that because of the nature of the disease process, it would not have been possible for the prescalene nodes to have evidenced any specific change.

† Refers to that group of patients for whom no definite diagnosis was ever established.

TABLE V
A COMPARISON OF THE SIZES OF THE LARGEST NODE FOUND ON PATHOLOGIC EXAMINATION OF THE BIOPSIED TISSUE

Node Size (cm.)	No. of Cases	Per cent of Each Size Positive*	Per cent of Total Positive Biopsies†
0.0 to 0.5	54	18.2	15.4
0.6 to 1.0	52	42.3	33.8
1.1 to 1.5	18	94.4	26.2
1.6 and larger	18	88.9	24.6

* Refers to the percentage of a specific node size found to be positive.

† Refers to the percentage of the total positive biopsies according to nodes of a specific size.

A complication rate of 2.6 per cent in 155 biopsies was noted. This arose from transection of the right lymphatic duct which was not recognized at the time of operation in one patient and from the same complication with the thoracic duct in another. The left cervical sympathetic was cut producing a Horner's

TABLE VI

CASE DISTRIBUTION BY CORRELATION WITH DIAGNOSIS OF PRIMARY INTRATHORACIC DISEASE

Final Diagnosis	Total No. of Cases	Per cent of Total	No. Positive	Per cent Positive*	No. Negative	No. Not Expected to be Positive	Questionable
Bronchogenic carcinoma	54	38.1	22	40.7	32	0	0
Boeck's sarcoid	34	23.9	27	79.4	6	0	1
Tuberculosis	12	8.5	3	30.0	7	2	0
Metastatic malignancy to lung	7	4.9	4	57.1	3	0	0
Lymphosarcoma	3	2.1	3	100.0	0	0	0
Hodgkin's disease	4	2.8	2	50.0	2	0	0
Thoracic malignancy	3	2.1	1	33.3	2	0	0
Carcinoma of esophagus	2	1.4	2	100.0	0	0	0
Anthracosilicosis	2	1.4	1	50.0	1	0	0
Rhabdomyosarcoma of lung	1	0.7	0	0	1	0	0
Inflammatory disease of lung	13	9.2	0	0	0	13	0
Esophageal ulcer	1	0.7	0	0	0	1	0
Mediastinal cyst	1	0.7	0	0	0	1	0
Thrombocytopenic purpura	1	0.7	0	0	0	1	0
Questionable	4	2.8	0	0	0	0	4

* Refers to the percentage of positive biopsies in the disease category.

syndrome in one patient, and the left phrenic nerve was cut in another patient.

An analysis of the cases in which the results were positive shows that of these sixty-five instances, there were forty-one right sided biopsies (63.1 per cent), twenty-one left sided (32.3 per cent), and three bilateral (4.6 per cent). The explanation for the low percentage of positive results in the bilateral biopsies is not apparent. In only one of the thirteen cases of bilateral biopsy, were the operative procedures performed at different times following a negative report on the first biopsy specimen. This would tend to eliminate the possibility that the second biopsy was more or less of a blind search for a definitive diagnosis. In the one case in which the procedures were staged, the second biopsy was positive. In no patient did both sides show a positive correlation.

In Table VI, the results of the biopsies have been separated with regard to the disease categories that were diagnosed.

Bronchogenic Carcinoma. A total of fifty-four patients or 38.1 per cent of the entire series were diagnosed as having bronchogenic carcinoma. A positive diagnosis was obtained in twenty-two patients by scalene node biopsy. In all instances, a positive biopsy was considered evidence of inoperability and the patients were not subjected to any further operative procedures. No attempt was made to correlate these results with the specific cell type of tumor, although the cellular pattern had some bearing in a relatively small group of patients who were later given chemotherapy for their disease. A final diagnosis of carcinoma of the lung was made in the thirty-two remaining patients by histologic section or in the case of three patients, by indisputable clinical evidence of a primary malignant lung tumor. One patient for whom no positive tissue diagnosis was made was included in the "questionable" disease category. Bronchogenic carcinoma was the probable diagnosis but there was the possibility that the disease process was produced by a lung abscess.

There are three patients included in Table VI under "thoracic malignancy." In two, the prescalene node biopsy was positive. In these patients, the tumor was extremely anaplastic and it was impossible even at necropsy, to be certain whether the malignancy arose from a bronchus or from contiguous mediastinal structures. They have therefore been included under a separate heading.

Boeck's Sarcoid. The use of prescalene lymph node biopsies in sarcoidosis provides pathologic tissue for examination which may solve a differential diagnostic problem between thoracic disease such as lymphoma or tubercu-

losis which can closely resemble the findings of sarcoidosis by roentgenogram of the chest.

The diagnosis of sarcoidosis was made in thirty-four cases or 23.9 per cent of the entire series. A positive diagnosis was obtained by scalene node biopsy in twenty-seven patients,

TABLE VII
SARCOIDOSIS: CORRELATION BETWEEN FINDINGS ON ROENTGENOGRAM OF CHEST AND PER CENT OF POSITIVE RESULTS ON PRESCALENE LYMPH NODE BIOPSY

	Total Cases	No. Positive	No. Negative	Per cent Positive
Parenchymal infiltrate...	9	6	3	66.7
Hilar mass.....	15	13	2	86.6
Both.....	9	8	1	88.9
Totals.....	33	27	6	79.4

which gave a positive correlation rate of 79.4 per cent in this disease. The modified Ziehl-Neelsen stain for the organisms of tuberculosis and Gridley stains for fungi were done on all biopsies in this category in addition to the routine hemotoxylin and eosin stains. If these latter procedures were negative and the clinical course of the patient was compatible with the diagnosis of sarcoid in terms of response to medical therapy, it was then considered that a positive correlation had been established. In three cases in which the clinical suspicion of sarcoid was strong, these criteria were not substantiated and these patients were included in the "questionable" category. In one case, a positive tissue diagnosis of sarcoid was obtained by biopsy of the nasal mucosa but the prescalene node biopsy was not considered diagnostic for this disease. This case was therefore classified under the "questionable" correlation category.

Further investigation of this group of patients show that seventeen of the thirty-four patients suspected of having sarcoid were Negroes and seventeen were Caucasians. Twelve of the seventeen biopsies were positive among the Negroes and fifteen were positive among the Caucasians.

The findings by roentgenographic examination of the chest of patients with sarcoid can be variable and range from large hilar and mediastinal masses with no evidence of pulmonary parenchymal infiltration to only parenchymal infiltrates with little or no hilar enlargement. Even the parenchymal infiltration can vary from single or multiple nodular areas to a fine linear network of increased densities with equal distribution throughout the entire lung.

While it is thought that these variable findings in sarcoidosis are a reflection of various stages of the disease process rather than different clinical entities [*11*] we have attempted to correlate the results of the prescalene node biopsy with the appearance on x-ray film of the pulmonary and mediastinal disease processes. (Table VII.) The one case in which the results were questionable has been excluded from this data. Thirty-three patients with sarcoid had biopsies of the prescalene nodes. In nine, only parenchymal infiltration was present on the roentgenograms of the chest. Fifteen had only hilar or mediastinal enlargement, and nine had both parenchymal infiltration and hilar or mediastinal enlargement. Approximately the same percentage (86.6 and 88.9) of the positive results were noted in those patients who had either hilar or mediastinal masses alone or in combination with parenchymal changes while 66.7 per cent of the cases of patients with only parenchymal changes were positive. The small number of patients precludes any absolute interpretation of this data but would suggest that the greatest percentage of positive correlations in sarcoidosis can be expected in patients who have hilar or mediastinal enlargement either alone or in combination with parenchymal changes.

Tuberculosis. A diagnosis of pulmonary tuberculosis was made in twelve patients. In two, the pulmonary lesion was found on thoracotomy to be old inactive tuberculosis and for this reason these cases are included in the "not expected to be positive" correlation category. Three patients had positive scalene node biopsies and these were corroborated by either acid-fast stain-showing organisms or by culture. In two of these patients miliary tuberculosis was diagnosed clinically and in only one patient was the primary diagnosis that of cavitary pulmonary tuberculosis.

Metastatic Lung Malignancy. Metastatic malignancy of the lung was diagnosed in seven patients who also had biopsies of the prescalene

lymph nodes. A positive correlation was found in four of these patients, either after thoracotomy or after further study and other operative procedures.

The reason for prescalene lymph node biopsy in these patients was either: (1) a chief complaint related to the pulmonary disorder and not to the primary source of the malignancy, or (2) if a malignant tumor had been previously diagnosed, then the pulmonary metastasis was a single one and sufficiently resembled a primary pulmonary lesion as to make thoracotomy mandatory unless a diagnosis could be made by some other means.

The sources of the metastatic malignancy to the lung and prescalene nodes were the breast, prostate, urinary bladder, and stomach. In all cases in which the prescalene node biopsy was negative, a diagnosis of the pulmonary disease was made after thoracotomy or necropsy. These included tumor metastatic to the lung from a pancreatic carcinoma, a fibrosarcoma of the leg, and an anaplastic carcinoma which was probably of either renal or thyroid origin.

A positive diagnosis of metastatic malignancy to the lung by prescalene node biopsy can prevent a patient from undergoing thoracotomy and in certain patients in whom the primary site of the tumor is not suspected, the source may be indicated. While in the majority of patients this would mean little in terms of curative therapy, in some situations such as lesions metastatic from a thyroid carcinoma, a positive diagnosis allows the initiation of palliative therapy which may prolong the patient's life for a considerable period of time.

Carcinoma of the Esophagus. Two patients with previously diagnosed carcinoma of the esophagus underwent prescalene node biopsy. In both cases the biopsy was positive for carcinoma and the patients were thereby judged to be inoperable. A right sided biopsy was performed in one patient and a left sided biopsy in the other.

There has been one previous report [*15*] in the literature of the attempt to determine the operability of an esophageal neoplasm by prescalene lymph node biopsy. Further study may indicate that prescalene lymph node biopsy may provide useful information of curability prior to surgical procedures on the esophagus.

Lymphoma. A total of seven patients with thoracic lymphoma underwent prescalene lymph node biopsy. Three patients were proved to have lymphosarcoma and in all the node biopsy was positive. Four patients had Hodgkin's disease, and of these, two had positive biopsies.

Non-specific Inflammatory Disease of the Lung. All of the patients who are included in this diagnostic category were included in the "not expected to be positive" correlation category. While many of these biopsies were diagnosed as chronic lymphadenitis, no definite evidence of the etiology of the intrathoracic disease was found in the node biopsy. These cases include unresolved pneumonitis (other than that arising from acid-fast or fungus etiology), as well as fibrotic changes in the lung which arose from previous acute and chronic non-specific pulmonary infections.

The remainder of the cases included in the "not expected to be positive" category were disease processes which could not have produced specific changes in the prescalene nodes.

SUMMARY

1. The case histories and biopsy specimens of 142 patients who had prescalene lymph node biopsies performed are reviewed. The biopsy correlated with the primary pulmonary disease in 52.5 per cent of the cases in which specific histological or bacteriological changes could have been found because of the nature of the intrathoracic disease. A major complication rate of 2.6 per cent was noted in this series.

2. The positive correlation rate was 40.7 per cent in fifty-four patients with bronchogenic carcinoma and 79.4 per cent in thirty-four patients with Boeck's sarcoid. The highest percentage of correlation in sarcoidosis was noted when hilar or mediastinal lymphadenopathy was present on the roentgenogram of the chest.

3. Other disease entities diagnosed by prescalene lymph node biopsies were tuberculosis, malignancy metastatic to the lung, intrathoracic lymphoma, carcinoma of the esophagus and anthracosilicosis.

REFERENCES

1. Daniels, A. C. A method of biopsy useful in diagnosing certain intrathoracic diseases. *Dis. of Chest*, 16: 360, 1949.
2. Rouvière, H. Anatomie des Lymphatiques de l'Homme. Paris, 1932. Masson & Cie. Translated by Tobias, M. J. Ann Arbor, 1938. Edwards Bros.
3. Weiss, H. A., Campbell, R. M., Budenz, G. C.

and McCandless, C. M. Sarcoidosis diagnosed by means of subclavian lymph node biopsy. *J. A. M. A.*, 146: 1221, 1951.
4. Johnson, J. E., Jr. and McCurdy, M. J. Pulmonary histoplasmosis diagnosed by scalene node biopsy. *Am. Rev. Tuberc.*, 66: 497, 1952.
5. England, J. Scalene node biopsy in diagnosis of intrathoracic disease. *Canad. M. A. J.*, 75: 265, 1956.
6. Storey, C. F. and Reynolds, B. M. Biopsy techniques in the diagnosis of intrathoracic lesions. *Dis. of Chest*, 23: 357, 1953.
7. Carstensen, B., Norvitt, L. and Odelberg, A. Experiences with retroclavian lymph node biopsy in the diagnosis of certain intrathoracic diseases. *Dis. of Chest*, 25: 443, 1954.
8. Johnson, J. E. Results of scalene node biopsy in patients with pulmonary calcifications. *Am. Rev. Tuberc.*, 72: 91, 1955.
9. Foley, F. E., Philbin, P. H., Kilpatrick, J. T. and Mansfield, M. O. P. Scalene node excision. *Surgery*, 40: 546, 1956.
10. Connor, R. G. Prescalene deep cervical lymph node biopsy. *Surg., Gynec. & Obst.*, 101: 733, 1955.
11. Shefts, L. M., Terrell, A. A. and Swindell, H. Scalene node biopsy. *Am. Rev. Tuberc.*, 68: 505, 1953.
12. Cuykendall, J. H. Use of prescalene lymph node biopsy in absence of palpable supraclavicular nodes: Report of 41 cases. *J. A. M. A.*, 155: 742, 1954.
13. Yang, W. W. Scalene node biopsy: An analysis of 42 cases. *California Med.*, 85: 165, 1956.
14. Piper, C. A. Scalene node biopsy in the diagnosis of diseases of the chest. *Am. Pract.*, 5: 182, 1954.
15. Harken, D. E., Black, H., Clauss, R. and Ferrand, R. A simple cervico-mediastinal exploration for tissue diagnosis of intrathoracic disease, with comments on the recognition of inoperable carcinoma of the lung. *New England J. Med.*, 251: 1041, 1954.
16. Correll, N., Jr. and Langston, H. T. The diagnosis of pulmonary lesions. *Illinois M. J.*, 109: 117, 1956.

"Marcello Malpighi . . . was born in 1628. He is one of the pioneers of microscopy, and the founder of histology. Malpighi was professor of anatomy at Bologna, Pisa, and Messina. He was physician to Pope Innocent XII from 1691 to 1694. He won wide recognition . . . as a biologist, having done gigantic work on the anatomy of the silkworm and the morphology of plants. Malpighi's researches in the embryology of the chick and the microscopic anatomy and physiology of the glands and viscera set him apart from his fellow men. It is all the more remarkable when one considers the tools at his command compared to present-day laboratory paraphernalia. In his Royal Society memoirs, 'De formatione pulli in ova' (1673) and 'De ova incubato,' are twelve plates which place him in the position of the founder of descriptive embryology. Malpighi described the red blood corpuscles in 1665, but he was preceded in this by Swammerdam by seven years. In addition he discovered the rete mucosum, and proved that the papillae of the tongue are the organs of taste. It is generally conceded that his most important work is the 'De Pulmonibus' (1661) which disproved the then held conception that pulmonary tissue was parenchymatous, and proving it to be vesicular in structure. Concerning his discovery of the capillaries (1660) it has been written, 'Harvey made their existence a logical necessity; Malpighi made it a historical certainty.' He devoted much labor to studies of the structure of the liver, kidney, and spleen, and his name has been preserved in the eponym, Malpighian bodies. In one of his works, he wrote an account of those lymphadenomatous formations which were described by Hodgkin in 1832 and termed by Wilks in 1856, Hodgkin's disease. In his private life he engaged in a bitter feud with his Pisan colleague, Borelli, and in an ancient feud between his family and a neighboring clan. These facts are interesting only because most of Malpighi's best works were lost to posterity due to wanton destruction in this family warfare. . . . Malpighi died at the age of sixty-eight years in 1694." (T. S. W., *Am. J. Surg.*, 12: 152, 1931.)

Recurrent Gallstone Ileus

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GALLSTONE ileus may be defined as a mechanical intestinal obstruction due to occlusion of the lumen of the bowel by a biliary calculus. This type of intestinal obstruction is unusual, has a high mortality rate, and accounts for approximately 1.5 per cent of all forms of mechanical intestinal obstruction. Less than nine hundred cases have appeared in the surgical literature.

Even more rare is a recurrence of intestinal obstruction due to another calculus in the same individual. This has been called recurrent gallstone ileus.

One of the earliest authors to cite such a sequence was Wagner [*23*], whose classic article in 1914 surveyed the world literature on gallstone obstructions and referred separately to two cases of recurrent gallstone ileus. In 1915 Downes [*3*] reported a case of recurrent gallstone obstruction in discussing a paper by Moschowitz. Pybus [*16*] recorded two cases in 1922 and was followed by Wohlauer [*25*], Hille [*7*], and Haas [*5*] who reported single cases each in elderly women. Holz [*10*], in 1929 summarized the subject and added two cases of gallstone intestinal obstruction. Neither of these cases, however, was a recurrent gallstone obstruction. Downing [*4*] reported five cases of gallstone ileus in 1948. One of these has been referred to as a case of recurrent gallstone obstruction but actually represented a "missed" obstruction from a single calculus. Ryan's [*19*] case reported in 1937 also fails to meet the criteria as a case of recurrent gallstone ileus.

Since 1929 twelve cases have been recorded by various authors and are added to the tabulation in Table 1. It is the purpose of this report to summarize nineteen cases of recurrent gallstone ileus, some of which were previously overlooked in reviews, and add two new cases.

CASE REPORTS

CASE 1. A. H. (No. 958-514), a sixty-eight year old white woman, was admitted to the Los Angeles County General Hospital on May 23, 1947, with a history of steady pain in the upper right abdomen for the past ten days. Forty-eight hours before admission there occurred an abrupt change in the character of her abdominal pain, which became intermittent, cramp-like, and was localized chiefly in the left lower quadrant. At the time of her admission the vomitus was watery brown and feculent.

On palpation moderate, generalized tenderness was elicited, most marked in the lower left and upper right abdomen. No mass could be felt. High-pitched, tinkling rushes were heard on auscultation, and a diagnosis of intestinal obstruction probably due to adhesive bands was made (postoperative herniorrhaphy). A scout film revealed a diffuse haze over the entire abdomen consistent with intraperitoneal fluid and late intestinal obstruction (Fig. 1.) The leukocyte count was 15,200 with 91 per cent neutrophils; non-protein nitrogen 52; carbon dioxide combining power 56; and amylase 130 units.

She was prepared for surgery and at operation on May 25, 1947, a 4 by 4 cm. gallstone was found obstructing the lumen of the distal ileum. Proximal to the gallstone was a small area of gangrene in the wall of the ileum and the peritoneal cavity contained a large amount of amber fluid. The stone was removed and the enterotomy closed with interrupted sutures of No. 000 silk. Except for a wound infection the convalescence was uneventful and the patient left the hospital on June 14, 1947.

Two months later she again entered the hospital with a history of cramping, periumbilical pains and vomiting of two days' duration. Pertinent abdominal findings included moderate distention (Fig. 1B), diffuse tenderness, high-pitched metallic tinkles and a succussion splash. It was believed that she had a small bowel intestinal obstruction, and on August 14, 1947 laparotomy was per-

TABLE I

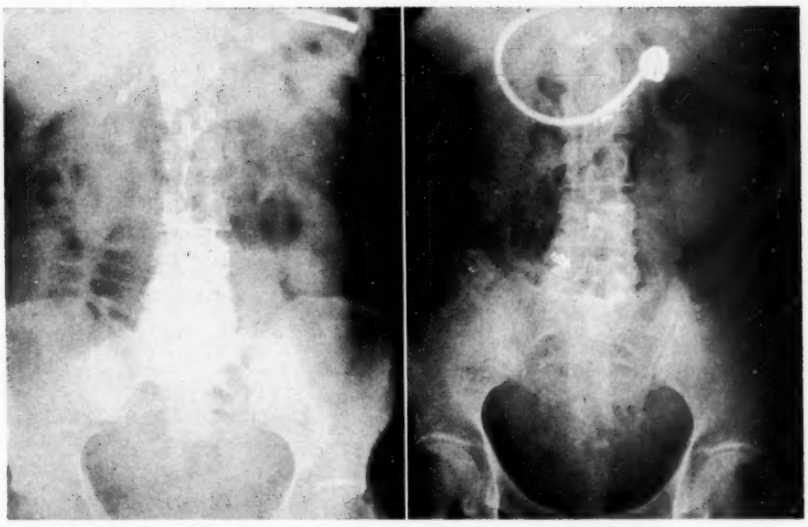
RECURRENT GALLSTONE ILEUS

Author	Age (yr.) and Sex	Site of Obstruction	Interval Surgeries	Result	Size of Stone	Upper Right Quadrant Explored (first surgery)	Remarks
Cook and Watkins [1]	67, F	Upper jejunum Rectum	5 mo	Lived	5 × 3½ cm. Slightly smaller	Yes Adhesions in area of gallbladder	First stone facetted
Downes [3]	....	"Same site both times"	2 days	.....	.....	.....	No other details
Haas [5]	69, F	Distal ileum Distal ileum	3 mo.	Lived	.....	.....	Size not given
Hand and Gilmore [6]	63, F	Upper jejunum Lower jejunum	8 days	Lived	"Over 1 in." "1 in."	Yes "Dense adhesions"	.....
Hille [7]	61, F	Pylorus Small bowel	4 days	Lived	Hen's egg Walnut	.....	Both facetted stones
Hinchey [8,9]	79, F	Jejunum Jejunum	3 mo.	Lived	3 cm. 3.2 cm.	.....	.....
Lee [11]	87, F	Lower ileum Upper ileum	3½ mo.	Lived	Walnut Golf ball	.....	.....
MacFarlane [12]	57, F	Ileum Ileum	20 days	Lived	2.5 cm. 3.8 cm.	.....	.....
Mast [13]	60, F	Conservative Rx, no surgery Upper ileum	1 mo.	Lived	2.5 × 2.5 cm.	Hard mass in gallbladder	.....
Milch, Mendez and Murphy [14]	67, F	Distal ileum Distal ileum	2 mo.	Lived	4.2 × 3 4 × 2.5	.....	.....
Noskin and Tannenbaum [15]	69, F	Distal ileum Distal ileum	13 mo.	Lived	Lime sized Golf ball	.....	.....
Pybus [16]	65, F	Terminal ileum Two feet above terminal ileum	4 days	Died	Golf ball Not given	.....	Two stones found at autopsy—ileum perforated peritonitis
Rogers and Carter [18]	68, F	Ileum Ileum	2 mo.	Lived	4 × 4 cm. 3 cm.	Yes Stones present	Six additional stones found at subsequent gallbladder and choledochostomy operations 3 mo. later. Gangrenous area in ileum
Rogers and Carter	67, F	Ileum Ileum	16 days	Lived	3 × 4 cm. 3 × 4 cm.	No	.....
Rogers and Carter	67, F	Terminal ileum Terminal ileum	7 mo.	Lived	2.5 × 2.0 cm. 3 × 2.8 × 2 cm.	No	Both facetted stones
Schwarke [20]	69, F	Ileum Ileum	4½ mo.	Lived	5.3 × 5.3 ⅝ × 5.3	No stones felt	Both facetted stones
Shore, Jacob and Cannon [21]	93, F	Lower jejunum Distal ileum	12 days	Died	3 × 2.5 cm. 3 cm.	Not examined	Another smaller stone found proximal to second stone at second surgery.
Van Ravenswaay [22]	71, F	Small intestine Rectum	10 days	Lived	⅔ size of golf ball Large	....	Digital removal from rectum
Wagner [23]	72, F	Distal ileum Distal ileum	12 days	Died	.....	.....	Both facetted stones
Wagner	72, F	Small bowel Small bowel	4 days	Lived	.....	.....	Both facetted stones
Wakefield, Vickers and Walters [24]	55, F	Rectum Ileum	18 hrs.	Died	3 × 4 cm. 4 × 5 cm.	.....	First stone removed from rectum digitally
Wohlauer [25]	69, F	Ileum Ileum	1 yr.	Lived	..... Walnut	.....	.....

formed. At surgery a 3 cm. facetted gallstone was found completely obstructing the terminal ileum. The gallstone was removed and the opening in the bowel closed as before. Other stones were felt in the gallbladder, but it was impossible to visualize a biliary fistula because of numerous adhesions incident to previous surgery.

Following recovery, she underwent an elective cholecystectomy and choledochostomy on September 25, 1947. A cholecystoduodenal fistula was found, and six additional stones were removed from the gallbladder. The fistulous opening was closed, a T tube placed in the common bile duct, and the abdomen was closed without drainage. She was discharged as asymptomatic on October 25, 1947.

CASE II. A. S. (No. 1576-2615), a sixty-seven year old white woman, entered the Los Angeles County General Hospital on May 5, 1955, with a thirty-six hour history of cramping periumbilical pain and vomiting. This was associated with



1A 1B

FIG. 1. CASE 1. A, initial scout film of abdomen showing diffuse haze and some small bowel distention, a picture consistent with advanced small bowel obstruction. No radiopaque calculi were seen. B, flat film of abdomen at time of second gallstone obstruction again fails to reveal a calculus but does show moderate small bowel distention and minimal gas in the colon.

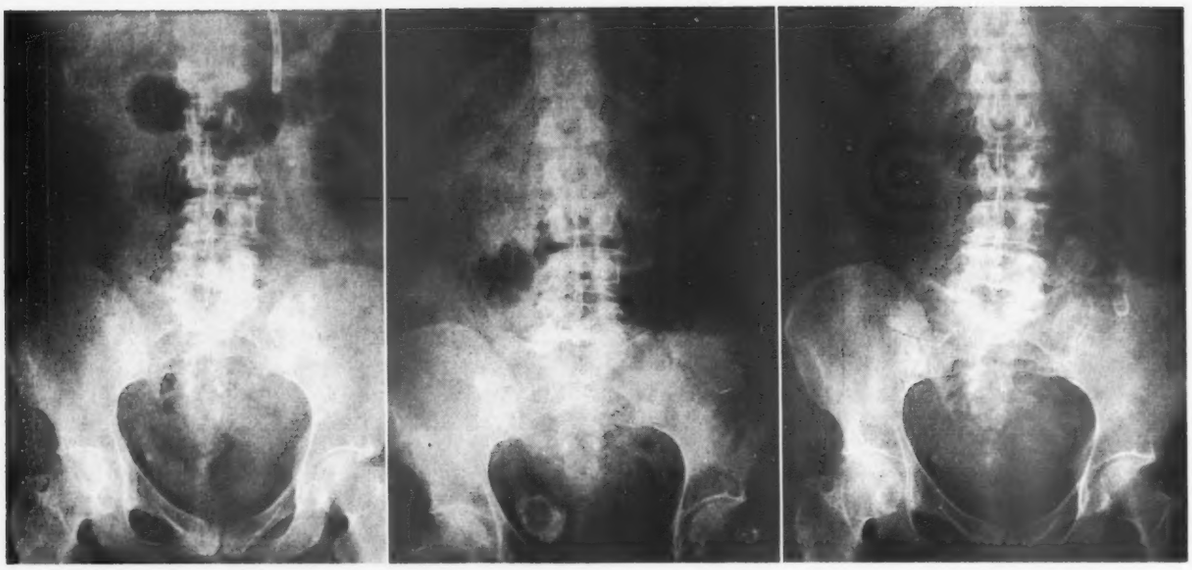
much epigastric distress, eructation of gas and a feeling of bloating for four days before admission. She had not passed flatus or stool per rectum since the onset of her illness. She had had several similar episodes in past months and gave a history of mild intolerance to fatty foods for many years. She had hypertensive heart disease and had been on digitalis for three years.

Examination disclosed an obese woman who complained of intermittent abdominal pain and vomiting. There was moderate abdominal distention with generalized tenderness. In the upper right abdomen there was suggestive fullness but no definite mass. Peristaltic sounds were hyperactive with accentuated borborygmi. Her temperature was 100.6°F. and the leukocyte count was 16,400 with 74 per cent neutrophils. The blood amylase was 190. An x-ray of the abdomen with the patient supine showed several loops of small bowel containing gas and fluid under moderate tension. (Fig. 2A and B.) A calcific density measuring 2.5 cm. in diameter was noted in the gallbladder region. It was believed that the patient had acute cholecystitis with moderate secondary inhibition obstruction. On barium enema examination no significant obstruction in the colon was seen.

The patient was given nasogastric suction, parenteral fluids and general supportive therapy. She improved clinically and was tolerating semisolid food until her fourth hospital day when there was a recurrence of abdominal distention, generalized tenderness, and hyperactive peristalsis and a succession splash. Repeat abdominal x-rays demonstrated generalized small bowel distention, air in the biliary tree and one laminated gallstone in the pelvic area. The patient was prepared for surgery.

At laparotomy on May 10, 1955, a 3 by 4 cm. gallstone was found completely obstructing the ileum about 2 feet proximal to the ileocecal valve. The calculus was removed through an enterotomy incision, which was closed transversely. Another large gallstone was palpable in the gallbladder, but because of the patient's critical condition further exploration was not attempted. The abdomen was closed without drainage. Her postsurgical course was without incident, and she was discharged on the seventh day for follow-up study in the outpatient department.

She was asymptomatic until the evening of May 25, 1955, when she again noted a rather gradual onset of cramping lower abdominal pains and vomiting. On examination she complained of severe rhythmic pains in the mid-abdomen recurring at intervals. On examination the abdomen was slightly distended with only minimal tenderness. Hyperactive peristaltic sounds were heard on auscultation. Supine abdominal x-ray revealed several loops of dilated, gas-filled small bowel. The previously noted gallstone had moved from the gallbladder and was visualized in a dilated small bowel segment in the lower abdomen. (Fig. 2C.) In addition, a slight amount of gas in the biliary tree was again seen. A diagnosis of recurrent gallstone ileus was made, and surgical exploration advised.



2A 2B 2C

FIG. 2. A, flat film of abdomen on admission May 6, 1955 reveals a large radiopaque calculus in right upper quadrant. Some distended small bowel is seen but essentially no gas in the colon. B, a later abdominal film reveals a second large calculus in the pelvic area which was not previously visible. More small bowel distention is seen along with a haziness consistent with increased extraluminal fluid. Small amounts of extraintestinal gas can be detected in the right upper quadrant interpreted as biliary emphysema. C, flat film taken at the time of recurrent gallstone intestinal obstruction. The calculus in the right upper quadrant has moved and is visible to the left of the lower lumbar vertebrae.

At surgery on May 26, 1955 (sixteen days after the first operation), another 3 by 4 cm. calculus at the site of the previous enterotomy in the ileum was found. The bowel was opened after injecting 1 per cent neomycin solution into the isolated segment and the stone extracted.

Further exploration was not attempted and the abdomen was closed. Her recovery was complete in one week and she was discharged to be followed up in the clinic.

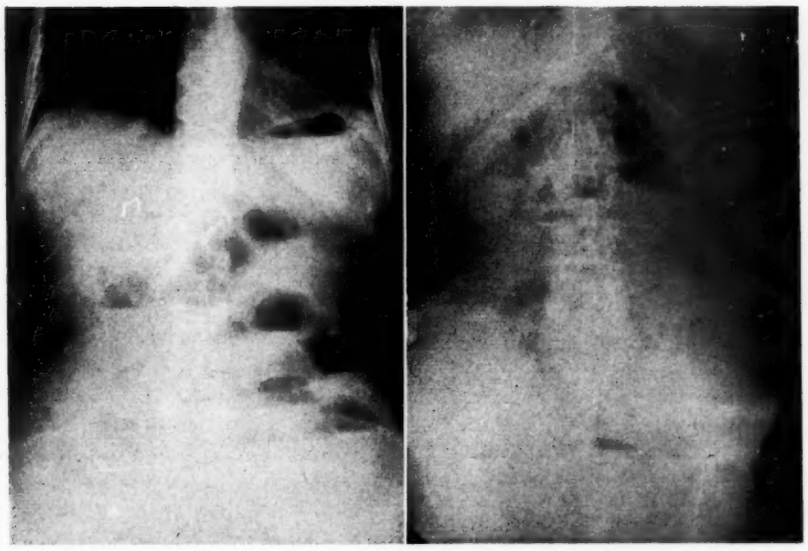
CASE III. B. R. (No. 2228), a sixty-seven year old Mexican widowed housewife, first entered the hospital in Whittier, California on May 5, 1957, with a chief complaint of nausea, vomiting and cramping abdominal pain. Her present trouble had begun four days earlier. Shortly after a normal bowel movement she noted increased gas and abdominal distress. On the following day these symptoms continued and she began to vomit intermittently. On the day of admission she again felt better, ate breakfast, but shortly after began again to have a cramping pain across the mid-abdomen and vomited.

In the past several years this patient had had intermittent periods of abdominal bloating and indigestion associated with upper right abdominal discomfort and occasional vomiting. She had never had abdominal surgery and her general health had been unusually good.

In the hospital a barium enema was not remarkable. Films of the abdomen with the patient in the supine and erect positions were consistent with a mechanical intestinal obstruction. (Fig. 3A.) A hemogram and urinalysis were noncontributory.

On the fifth day of her illness she was taken to surgery where a multifacetted gallstone measuring 2.5 by 2.0 cm. was removed from the terminal ileum. The upper right quadrant of the abdomen was not explored at operation. Her course was uneventful after surgery.

The patient was again seen on December 13, 1957, when she complained of cramping abdominal pain, nausea and vomiting. She was seen at home by her private physician and medications were ordered. There was no improvement in twenty-four hours and hospitalization was advised. On December 15, 1957, a consultant was called and a diagnosis of recurrent gallstone ileus was made. X-ray films showed distended small bowel loops with fluid levels on the film of the patient in the upright position. There was no gas in the colon; no calculi were visible. (Fig. 3B.) The patient was hydrated intravenously, antibiotics were administered and emergency surgery carried out. A 3 by 2.8 by 2 cm. facetted gallstone was found obstructing the lumen of the ileum approximately 8 inches proximal to the site of the previous enterotomy which was identified by interrupted



3A 3B

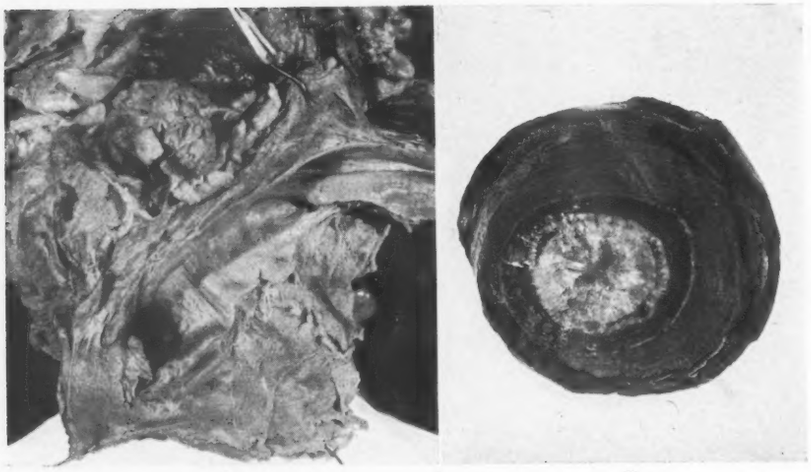
FIG. 3. CASE III. A, film of abdomen with patient in upright position taken at the time of first gallstone obstruction shows multiple fluid levels in dilated small bowel. The findings are consistent with a well established mechanical small bowel obstruction. B, an abdominal film with patient in erect position taken seven months later at the time of the patient's second gallstone intestinal obstruction fails to show either a radiopaque stone or air in the biliary tract but is compatible with a small bowel obstruction. A second large calculus was lodged in the lower ileum.

silk sutures on the antimesenteric surface. The stone was removed through a small incision placed in a portion of the ileum proximal to the obstruction and the enterotomy was closed transversely with interrupted No. 0000 silk sutures. The upper right quadrant of the abdomen was palpated carefully and a firm, sclerotic gallbladder measuring approximately 6 by 3 cm. was palpable. There was intense scarring in this area and it was only possible to determine that there were no further stones present. This operation was performed through a short, lower right quadrant transverse incision which was closed with interrupted vertical mattress stitches of stainless steel wire.

The patient spent a very uneventful postoperative course and was discharged on her fifth postoperative day.

Pathogenesis. There are various routes by which gallstones may enter the gastrointestinal tract [24], but by far the most common portal of entry of large gallstones is through a cholecystoduodenal fistula. (Fig. 4.) Spontaneous biliary fistulas usually result from acute obstructive cholecystitis in the presence of gallstones. Accompanying pericholecystitis produces inflammatory adhesions between the gallbladder and adjacent viscera. The gallstones by pressure erosion ulcerate through an inflammed or gangrenous gallbladder wall to form a fistulous communication. Once having entered the alimentary tract, a gallstone may be vomited, may pass spontaneously by rectum, or may produce intestinal obstruction. Most of these gallstones are passed through the intestinal tract without incident, and it is estimated that in only about 2 per cent of cases of cholecystoenteric fistula does the gallstone cause intestinal obstruction. Stones which produce obstruction are generally over 2 cm. in diameter. These become lodged where the intestinal lumen is smallest, most often in the terminal ileum. Smaller stones, particularly if they are facetted and contain sharp edges, may cause sufficient bowel spasm to incite obstruction. In gallstone ileus the presence of multiple calculi within the small bowel is not an uncommon occurrence. The removal from the bowel of an obstructing facetted stone should suggest the presence of other stones higher in the intestine or still in the gallbladder. (Fig. 5.)

Incidence. The actual incidence of this type of intestinal obstruction is difficult to state. A collected series of 30,508 obstructions



4A 4B

FIG. 4. A, specimen shows open segment of duodenum with large cholecystoduodenal fistula. B, large calculus seen occluding the cholecystoduodenal fistula in Figure 4A. Stones of this size almost invariably cause bowel obstruction once they have migrated into the lumen of the intestine.

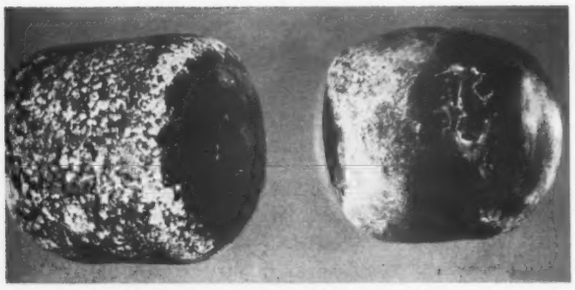


FIG. 5. Such large calculi as these may be responsible for recurrent gallstone intestinal obstructions. The removal of a facetted stone from the intestinal tract should stimulate search for one or more similar stones higher in the bowel or within the gallbladder.

was averaged to give an incidence of gallstone obstructions of 1.5 per cent [*18*].

In keeping with the preponderance of cholelithiasis in females, it is not surprising that gallstone ileus is most commonly a disease of elderly women with gallstones. An analysis was done of the cases of recurrent gallstone ileus appearing in medical records to this time. (Table 1.) The average age was sixty-two years and all were women. From a review of over 400 of the more recently reported cases of gallstone intestinal obstruction the average age of patients was found to be sixty-four years. The sex ratio for the group was 7.5:1 favoring the females [*18*].

Diagnosis. Although a correct diagnosis of gallstone ileus is seldom made preoperatively, an awareness of the condition should permit its recognition in many instances. Obturator obstruction is the only form of intestinal obstruction in which the obstructive level may shift. The obstruction may be intermittently relieved as the stone migrates downward within the bowel lumen. This intermittent severe ileus is characteristic of obturator obstruction but misleading to the diagnostician.

When a gallstone completely blocks the intestinal lumen, a mechanical obstruction results. There is also danger of pressure erosion and subsequent perforation of the bowel wall at the site of impaction. For this reason, gallstone ileus should be regarded as a potentially strangulating obstruction from its onset [*2*].

Gallstone ileus should be seriously considered in the elderly patient with acute intestinal obstruction upon whom no prior abdominal surgery has been performed, and where incarcerated hernia is not a factor. A history compatible with previous disease of the gallbladder or biliary colic is suggestive. The diagnosis may be suspected in acute cholecystitis when accompanied by excessive nausea and vomiting or refractory ileus.

The most valuable diagnostic aid in gallstone ileus is x-ray examination of the abdomen. Rigler, Borman and Noble [*17*] have established four roentgen signs which are almost pathognomonic of gallstone intestinal obstruction: (1) air or occasionally contrast media in the biliary tree; (2) direct visualization

of the stone or sometimes indirect visualization of the stone by means of contrast media within the intestine; (3) a change in position of previously noted stone; and (4) evidences of partial or complete intestinal obstruction. Biliary tract air coupled with roentgen signs of intestinal obstruction (Rigler's sign) is practically diagnostic of gallstone ileus.

If ileus persists or recurs after gallstone intestinal obstruction, either in the immediate postoperative period or later, the possibility of recurrent gallstone ileus due to a "missed" or a second stone must be considered.

Treatment. The proper treatment of gallstone intestinal obstruction is surgical, and laparotomy should be performed as soon as the patient can be prepared for surgery. Intubation, restoration of fluid and electrolyte deficits, antibiotic administration and other supportive measures are fundamental objectives in the management of any acute intestinal obstruction.

Recurrent gallstone ileus demonstrates the necessity for examining the entire bowel at exploration to rule out the presence of multiple calculi. This should also include a prior digital rectal examination. Probably most instances of recurrent gallstone ileus in the immediate postoperative period result from additional missed stones. Furthermore, the presence of collapsed bowel distal to a known obstructing calculus does not always exclude the possibility that a second stone may be hidden beyond. The recovery of a facetted stone should also alert the surgeon to the likelihood of an additional matching stone in the gastrointestinal tract, and its presence should also make palpation of the gallbladder mandatory at the time of surgery.

Once located, an attempt can be made to advance the obstructing stone into the colon and around into the rectum. This appears to be the treatment of choice if it can be performed easily. If the stone can be dislodged and removed proximally, it can be removed through an incision in healthy bowel. A 1 per cent solution of neomycin injected into the involved bowel segment prior to enterotomy may be of value. Additional stones in the gallbladder should be removed by cholecystostomy if the patient's condition permits. Probably no attempt should be made to close the cholecystoenteric fistula at this time. An interval cholecystectomy is indicated if symptoms of gallbladder disease persist, unless contraindicated by a grave surgical risk.

CONCLUSIONS

1. Nineteen cases of recurrent gallstone intestinal obstruction have been collected and reviewed and two new cases are reported.

2. Recurrent gallstone obstruction is due to a second gallstone intestinal obstruction in the same patient. Such a recurrence can be avoided by careful search of the entire intestinal tract and the gallbladder for additional stones at the time of surgical removal of the first obstructing calculus.

3. The recovery of a facetted stone from the obstructed small bowel should make further exploration mandatory. When additional large calculi are noted in the gallbladder, immediate cholecystostomy should be performed, if the condition of the patient permits.

REFERENCES

1. Cook, P. H. and Watkins, R. P. Recurring intestinal obstruction due to gallstone ileus. *New England J. Med.*, 207: 462–465, 1932.
2. Dennis, C. Operative Technique in General Surgery, chap. 10, p. 454. Edited by Cole, W. New York, 1954. Appleton-Century-Crofts, Inc.
3. Downes, W. A. Discussion of Moschowitz. *Ann. Surg.*, 61: 243–244, 1915.
4. Downing, W. L. Gallstone ileus; report of five cases. *J. Iowa M. Soc.*, 38: 95–100, 1948.
5. Haas, W. Demonstrationen-Vereinigung Münchener Chirurgen. *Zentrabl. Chir.*, 54: 2775, 1927.
6. Hand, B. H. and Gilmore, W. E. Gallstone ileus: recurrence in one case. *Am. J. Surg.*, 59: 72–78, 1943.
7. Hille, K. Zweifacher Gallenstein ileus. *Münchcn med. Wchnschr.*, 72: 597–598, 1925.
8. Hinchey, P. R. Gallstone ileus. *Arch. Surg.*, 46: 9–26, 1943.
9. Hinchey, P. R. Recurrent gallstone ileus. *New England J. Med.*, 223: 174–179, 1940.
10. Holz, E. Zur frage des gallensteinileus. *Arch. klin. Chir.*, 155: 166–176, 1929.
11. Lee, M. Intestinal obstruction by gallstones. *Brit. M. J.*, 1: 555, 1945.
12. MacFarlane, J. A. Recurrent gallstone ileus. *Brit. M. J.*, 2: 544–545, 1953.
13. Mast, W. H. Recurrent intestinal obstruction due to gallstone. *Am. J. Surg.*, 32: 516–518, 1936.
14. Milch, E., Mendez, F. L., Jr. and Murphy, H. Recurrent gallstone small bowel obstruction. *Arch. Surg.*, 64: 847–850, 1952.
15. Noskin, E. Q. and Tannenbaum, W. C. Recurrent gallstone ileus. *Surgery*, 31: 599–601, 1952.
16. Pybus, F. C. A note on two cases of gallstone ileus. *Lancet*, 2: 812, 1922.
17. Rigler, L., Borman, C. and Noble, J. Gallstone

obstruction: pathogenesis and roentgen manifestations. *J. A. M. A.*, 117: 1753–1759, 1941.
18. Rogers, F. and Carter, R. Gallstone intestinal obstruction: a review and presentation of forty new cases. *California Med.*, 88: 140–143, 1958.
19. Ryan, C. A. Intestinal obstruction due to gallstones. *Canad. M. A. J.*, 36: 167–168, 1937.
20. Schwarke, R. Über Zweimaligen Gallensteinileus. *Zentralbl Chir.*, 65: 1980–1985, 1937.
21. Shore, Z., Jacob, H. H. and Cannon, J. A. Intestinal construction resulting from biliary calculi (gallstone ileus). *Arch. Surg.*, 66: 301–311 1953.
22. van Ravenswaay, A. Acute intestinal obstruction by large gallstone. *Am. J. Surg.*, 16: 56, 1932.
23. Wagner, A. Ileus durch Gallenstein. *Deutsche Ztschr. Chir.*, 130: 353–388, 1914.
24. Wakefield, E., Vickers, P. and Walters, W. Intestinal obstruction caused by gallstones. *Surgery*, 5: 670–673, 1939.
25. Wohlauer, W. Quoted by Holtz, E. Zur frage des gallensteinileus. *Arch. Klin. Chir.*, 155: 167, 1929.

"Niels Stensen, or Steno, was born in 1638. He resided in Copenhagen. He was a physician-priest. His was a busy life; his vocations were many. A romantic chapter in history deals with his conversion to Catholicism by a sister of that Church. He devoted the better part of his life to religious work. Shortly after his conversion from the Lutheran faith he became Bishop of Tritiopolis (1667). The other side of the man revealed the scientist. He was a great anatomist, geologist, and physiologist. Stensen is known as one of the founders of geology. The geologists of all countries erected, in 1883, a bust over his tomb in the Basilica San Lorenzo in Florence. His treatise, 'De solido intra solidum' (1669) was epoch making and deals with the production of fossils, strata, and other geologic formations. In anatomy, his name is known to physicians because of his discovery of the excretory duct of the parotid gland, Stensen's duct (1661). He discovered the duct while dissecting a sheep. ('Observationes anatomicae,' Leyden, 1662.) Stensen, among other works, investigated the glands of the eye and in 1664 ('De musculis et glandulis observationum specimen,' Copenhagen) he recognized the muscular nature of the heart. In his discourses on the anatomy of the brain he fell into the common errors of his time. Much of his working time was spent in further studies on the physiology of muscles. He was particularly interested in them from the mechanical and mathematical viewpoints. From the surgeon's viewpoint he is known because of his anatomical discoveries; the physiologist knows him because of his work on muscles; the geologist as the father of geology. Stensen, priest and scientist, died at the age of seventy-four years, in 1727." (T. S. W., *Am. J. Surg.*, 14: 501, 1931.)

In Vivo Effects of Peritoneal Fluid Resulting from Strangulated Intestinal Obstruction

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THE cause of death following strangulation of a small segment of lower ileum has not been clearly established. The amount of involved gut is not great enough to accommodate an extensive volume of blood. In experimental animals death supervenes before there is time for fluid and electrolyte loss of lethal proportions. Postmortem examination reveals no evidence of suppurative peritonitis [6].

Following the creation of a closed loop obstruction of strangulated bowel, the peritoneal cavity is found to be the site of collection of large amounts of dark, foul fluid. The lethal properties of this material, when injected into the peritoneal cavities of normal animals, has been demonstrated [1,2]. A concern for the physiologic alterations produced in normal animals by the administration of fluid recovered from the peritoneal cavities of animals with strangulated obstruction prompted the following experiments.

MATERIALS AND METHODS

Twenty-six adult mongrel dogs were divided into five groups.

Group I. Eight animals served as donors for the peritoneal fluid used in these studies. Utilizing sterile technic, the terminal ileum was exposed through a lower midline abdominal incision. The venous supply to a segment of intestine just proximal to the cecum was divided, following which umbilical tape ties were snugly placed around each extremity of a 10 cm. segment. All vessels running parallel to the long axis of the bowel, at the two sites of obstruction, were divided and ligated [2]. The closed loop of obstructed, strangulated bowel was then returned to the abdominal cavity. After closure of the abdominal wound the animals were placed in their cages.

At, or shortly before, death the abdominal cavity was opened and the free peritoneal fluid was removed. It was placed in a sterile container and refrigerated until used.

Group II. Four healthy adult mongrel dogs were lightly anesthetized with intravenous nembutal,® following which a femoral artery was cannulated for withdrawal of blood samples. A control specimen was removed from each animal immediately after insertion of the cannula. A dose of 4 cc. of fluid per kg. of body weight was injected directly into the peritoneal cavity of each animal. Blood samples were collected at three-, five- and seven-hour intervals after injection of the fluid. Red, white and differential blood cell counts were made. The hematocrit was determined by standard methods, using a Wintrobe tube. One cubic centimeter of fresh arterial blood for platelet counts was collected directly into a clean tube containing .1 cc. of potassium oxylate. Prothrombin time was determined from 4½ cc. of blood collected directly into a graduated centrifuge tube containing .5 cc. of potassium oxylate. Clotting time values were obtained by placing 1 cc. of whole blood in each of three test tubes. Each tube in succession was gently tilted from side to side until clotting occurred. The clotting time was recorded as that time between the entrance of the blood into the syringe and clot formation in the third tube. Plasma hemoglobin was determined according to the method of Dacie [8]. Sodium and potassium determinations were made on fresh serum, utilizing the flame photometer. The temperature, pulse rate and respiratory rate of each animal were recorded at three-, five- and seven-hour intervals.

Group III. Four normal adult mongrel dogs were lightly anesthetized with intravenous nembutal. A femoral artery was cannulated for withdrawal of blood samples. The opposite femoral vein was cannulated for the administration of peritoneal fluid which was prepared

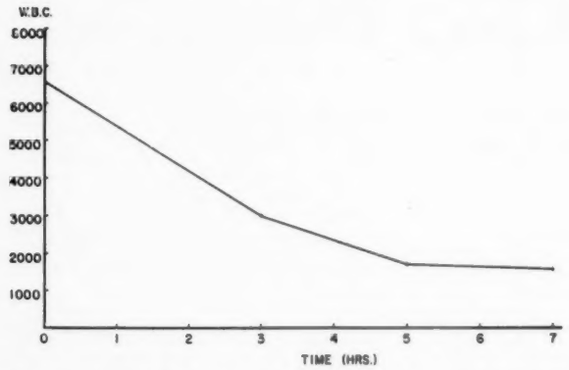

FIG. 1. Typical white blood cell response following intraperitoneal injection of fluid.

by mixing 4 cc. per kg. of this material with 450 cc. of isotonic saline. This solution was allowed to flow at the rate of 15 drops per minute. Blood samples were collected before and at intervals of two, four and six hours after beginning the drip. White and red blood cell counts, along with hematocrit and clotting time determinations, were made. Serum sodium and potassium levels as well as respiratory and pulse rates were recorded. The temperature of each animal was also observed.

Group IV. Utilizing intravenous nembutal anesthesia a segment of ileum was strangulated according to the method described heretofore. The altered bowel was put in a plastic bag and fixed in place with a snug tie of umbilical tape. Polyethylene bags with a volume of 1 quart were used [4]. The bag and its contents were returned to the peritoneal cavity, following which the abdominal wound was closed. Forty-eight hours later control blood samples were collected and the wound was reopened. A hole was made in the plastic bag allowing escape of the fluid into the abdominal cavity. As long as the animals lived, blood samples were obtained at two-hour intervals for the determina-

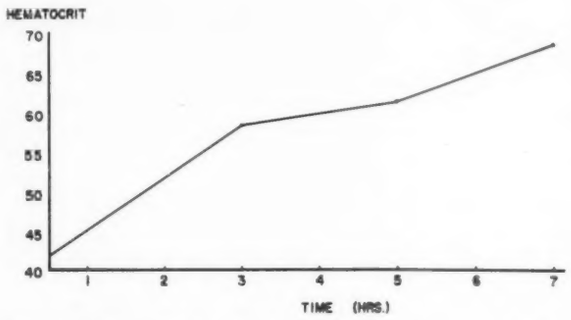

FIG. 2. Hematocrit changes following intraperitoneal injection of fluid.

TABLE I

EFFECTS OF INTRAPERITONEAL FLUID ON CELLULAR ELEMENTS OF BLOOD

Dog No.	Time (hr.)	White Blood Cells ($\times 10^3$)	Red Blood Cells ($\times 10^6$)	Hematocrit (%)
78	Initial	6.5	4.9	42
	3	3.0	5.0	58
	5	1.7	5.4	61
	7	1.5	5.7	68
45	Initial	12.1	4.2	33
	3	3.0	4.5	47
	5	2.4	5.1	50
	7	2.5	5.7	51
161	Initial	8.3	5.0	46
	3	3.3	5.9	58
	5	2.9	6.5	66
	7	2.6	7.0	71
80	Initial	6.3	4.4	30
	3	2.8	5.4	45
	5	1.4	6.2	50
	7	2.2	6.5	53

TABLE II

DIFFERENTIAL WHITE BLOOD CELL COUNTS FOLLOWING INTRAPERITONEAL INJECTION OF FLUID

Dog No.	Time (hr.)	Polymorphonuclear Leukocytes (%)	Lymphocytes (%)	Eosinophils (%)	Basophils (%)	Monocytes (%)
78	Initial	66	26	3	2	3
	3	50	44	3	1	2
	5	50	46	3	0	1
	7	51	42	4	0	3
45	Initial	69	20	8	0	3
	3	67	28	2	0	3
	5	65	30	4	0	1
	7	70	24	4	0	2
80	Initial	63	27	10	0	0
	3	56	36	8	0	0
	5	57	36	3	0	4
	7	38	55	5	0	2

tion of white and red blood cell counts, hematocrit, plasma hemoglobin, potassium and sodium.

Group V. Peritoneal fluid resulting from strangulation obstruction was centrifuged at 17,000 revolutions per minute. The supernatant fluid was separated from the centrifugate so that the fraction could be given to different animals. Six normal dogs were lightly anesthetized with intravenous nembutal, following which a femoral vein was cannulated for withdrawal of blood samples. After a control sample had been collected, one-half of the animals were given an intraperitoneal injection of supernatant fluid in the amount of 4 cc. per kg. while the remainder of the animals received a corresponding amount of the centrifugate by the same route of administration. Blood samples were collected at four- and eight-hour intervals after injection of the peritoneal fluid fractions for determination of the white blood cell values.

TABLE III
PLASMA HEMOGLOBIN, PLATELETS AND CLOTTING TIME OF NORMAL DOG FOLLOWING INTRAPERITONEAL INJECTION OF FLUID

Dog No.	Time (hr.)	Plasma Hemoglobin (mg. %)	Platelets ($\times 10^4$)	Clotting Time (min.)
78	Control	3.25	4.2	1.9
	3	18.17	9.8	1.8
	5	18.65	14.8	3.2
	7	33.00	13.6	2.0
45	Control	2.5	20.0	2.1
	3	8.0	10.5	6.2
	5	15.0	8.2	6.6
	7	9.6	....	7.0
161	Control	2.87	16.4	7.6
	3	3.62	16.6	6.5
	5	11.50	16.6	6.2
	7	17.80	12.8	6.4

RESULTS

Group I. The early postoperative course of these animals did not differ from that usually pursued following laparotomy. After about twenty-eight hours they rapidly developed an increase in respiration, became lethargic and were dead within two hours. The peritoneal fluid of each animal yielded from 200 to 300 cc. of dark, foul fluid. Although no area of gross perforation could be found, the obstructed segment was usually collapsed and free of fluid.

Group II. One of the most striking findings was the precipitous drop in circulating white blood cells. (Fig. 1.) After exposure to the fluid for three hours, the white blood cell count of all animals was found to be less than 50 per cent of the control value. (Table 1.) The mean control count was 8,300 per cu. mm., changing to 2,213 per cu. mm. seven hours after injection of the fluid. Although it was not consistently true, most animals were found to have a relative increase in lymphocytes as revealed by the differential white cell counts. (Table II.) An increase in the concentration of circulating red blood cells was consistently found in all animals. (Table 1.) This change was also reflected in the hematocrit which showed a rise of 50 per cent in all cases. (Fig. 2.) During the period of observation there was a progressive increase in the concentration of plasma hemoglobin. (Table III.) The mean preinjection value of 2.87 mg. per cent rose to 20.13 mg. per cent after seven hours. There was no significant alteration of the prothrombin time. The blood platelets as well as the clotting time remained within normal limits. (Table III.) The plasma sodium level remained unchanged during the period of observation. Although there was a slight, progressive rise in the serum potassium concentration, this value was never above 5.1 mEq. per L. (Table IV.) All animals showed an increase in the rate of respiration. In most cases

TABLE IV
SODIUM AND POTASSIUM VALUES FOLLOWING INTRAPERITONEAL INJECTION OF FLUID

Dog No.	Time (hr.)	Sodium (mEq./L.)	Potassium (mEq./L.)
78	Control	146	3.4
	3	148	3.7
	5	149	4.2
	7	150	5.0
45	Control	152	3.8
	3	149	4.2
	5	148	4.8
	7	146	5.1
161	Control	161	3.5
	3	160	3.9
	5	159	4.2
	7	158	4.5

there was a slight rise in temperature. Changes in pulse rate were not significant. (Table v.)

Group III. The blood of all animals revealed a marked decrease in the number of circulating white blood cells two hours after administration of the fluid was begun. In only one animal did the white blood cell count climb back to the normal level during the period of observation. The lowest value reached was 1,400 per cu. mm. and this animal died four hours after the drip had been started. (Table vi.) Differential white cell counts again revealed a relative lymphocytosis with a comparable decrease in the number of polymorphonuclear leukocytes. Hemoconcentration as evidenced by a rising red blood cell count was evident in

TABLE V

TEMPERATURE, PULSE AND RESPIRATORY RATES IN NORMAL DOGS FOLLOWING INTRAPERITONEAL INJECTION OF FLUID

Dog No.	Time (hr.)	Respirations (per min.)	Pulse (per min.)	Temp. (°c.)
78	Control	10	138	37.5
	7	21	136	38.5
45	Control	7	94	38.0
	7	10	104	36.5
161	Control	14	138	37.5
	7	112	136	39.3
80	Control	15	120	37.5
	7	30	212	39.0

TABLE VI

CHANGES IN THE BLOOD OF NORMAL DOGS FOLLOWING THE INTRAVENOUS ADMINISTRATION OF FLUID

Dog No.	Time (hr.)	White Blood Cells ($\times 10^3$)	Red Blood Cells ($\times 10^6$)	Hematocrit (%)	Clotting Time (min.)
147	Control	7.8	4.6	36	7.6
	2	3.8	4.9	44	9.0
	4	3.5	5.2	45	9.0
	6	3.6	5.8	50	9.2
	7	3.8	6.3	46	10.0
110	Control	9.7	4.1	25	9.2
	2	3.7	4.8	36	11.1
	4	3.8	5.5	39	15.0
	6	6.2	5.5	41	13.7
	7	10.4	4.6	43	13.8
199	Control	7.8	5.6	46	8.6
	2	1.4	5.9	51	10.5
	4	1.4	6.4	53	16.0
	(Died)				
189	Control	11.3	4.9	36	9.5
	2	2.7	6.3	53	9.2
	4	2.7	6.4	54	16.0
	6	2.5	5.2	50	15.0
	(Died)				

TABLE VII

CHANGES IN BLOOD ELEMENTS FOLLOWING EXPOSURE OF ANIMALS TO THEIR OWN STRANGULATION OBSTRUCTION FLUID

Dog No.	Time (hr.)	White Blood Cells ($\times 10^3$)	Red Blood Cells ($\times 10^6$)	Hematocrit (%)
83	Initial	59.8	6.2	42
	2	5.9	6.3	47
125	Initial	30.0	5.9	44
	2	3.6	5.9	46
143	Initial	16.0	5.6	47
	2	5.9	5.9	51
	4	3.7	6.0	53
198	Initial	26.0	4.1	35
	2	7.3	5.0	44
	4	4.2	5.9	47

TABLE VIII

PLASMA HEMOGLOBIN, SODIUM AND POTASSIUM VALUES FOLLOWING EXPOSURE OF ANIMALS TO THEIR OWN STRANGULATION OBSTRUCTION FLUID

Dog No.	Time (hr.)	Plasma Hemoglobin (mg. %)	Sodium (mEq./L.)	Potassium (mEq./L.)
83	Initial	10.7	149	4.8
	2	18.8	154	4.8
125	Initial	9.1	149	4.3
	2	40.8	150	8.5
143	Initial	8.8	148	5.5
	2	22.8	159	6.1
	4	58.0	155	7.9
198	Initial	3.5	146	3.8
	2	22.0	149	4.5
	4	36.0	149	4.5

all animals. Animal No. 199, which died four hours after administration of the fluid was started, revealed a final red blood cell count of 6,400,000 per cu. mm. Increased concentration of blood elements were also evidenced by a rising hematocrit. In no instance was there a fall

TABLE IX
MEAN WHITE BLOOD CELL VALUE ($\times 10^3$) FOLLOWING INTRAPERITONEAL INJECTION OF FRACTION OF STRANGULATION OBSTRUCTION FLUID INTO NORMAL ANIMALS

Fraction	Initial	4 hours	8 hours
Toxic	13.3	4.5	3.0
Non-toxic	8.9	10.2	22.5

in the hematocrit. (Table v.) There was a gradual increase in the clotting time of all animals which received intravenous fluid. (Table vi.) The longest clotting time, 16 minutes, was seen in the two animals which died before the seven-hour period had expired. Serum sodium and potassium levels were not significantly altered.

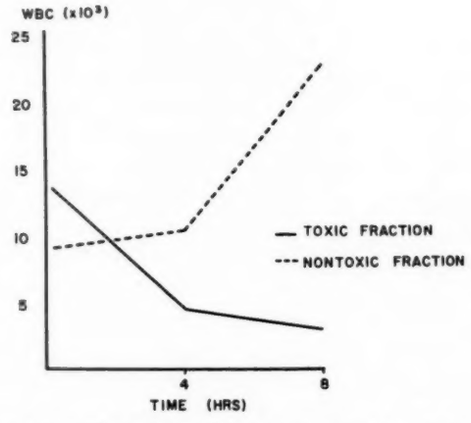

FIG. 3. The effects of fractions of strangulation obstruction fluid on white blood cell values.

Group IV. Two of the animals were dead within three hours and the others were dead within five hours after exposure to the fluid. The mean control white blood cell count for the four animals was 32,950 per cu. mm. After two hours this value had decreased to 6,175 per cu. mm., and after four hours the two living dogs had a mean white blood cell count of 3,950 per cu. mm. (Table vii.) There was a slight, progressive rise in the red blood cell count as well as the hematocrit. A progressive rise in plasma hemoglobin was observed in all animals. Changes in serum sodium were not great but a gradual rise in potassium concentration was recorded. (Table viii.)

Group V. The animals which received the toxic centrifugate had a mean control white blood cell count of 13,300 per cu. mm. (Table ix.) Within four hours it had dropped to 4,500 per cu. mm., and after eight hours this value was 3,000 per cu. mm. Where the non-toxic supernatant fluid was administrated, the mean control white blood cell count was 8,900 per cu. mm. Four hours after injection this value had changed to 10,200 per cu. mm., and after eight hours it was found to be 22,500 per cu. mm. (Fig. 3.)

COMMENTS

It is now well established that the peritoneal fluid which results from strangulation obstruction plays an important role in the lethal outcome of this condition. Experimental animals will tolerate an intra-abdominal segment of strangulated bowel much longer if it is placed in a plastic bag so that exposure to the product of strangulation is prevented [4]. Rupture of the bag with escape of the fluid is followed by a rapid downhill course. In all animals which were exposed to the toxic fluid, severe, progressive leukopenia resulted. This was also observed following exposure to the toxic fraction of the raw fluid. A leukopenia of this magnitude undoubtedly significantly impaired the animals' defense mechanisms at a time of great crisis since Escherichia coli, Proteus vulgaris, Clostridium welchii and beta hemolytic streptococcus have been identified in the fluid resulting from strangulation obstruction [5,7]. It is probable that the white blood cells are destroyed by some component of the fluid or trapped in one of the viscera so that they are removed from the circulation. The alpha toxin of the Cl. welchii has been identified in peritoneal fluid of animals with strangulation obstruction [9]. Administration of this material resulted in a leukocytosis rather than leukopenia [3]. Furthermore, it seems unlikely that an exotoxin would be removed from the fluid by centrifugation. In other experiments [6] it has been shown that passage of toxic fluid through a Seitz filter removed the lethal component, which is additional evidence against

an exotoxin playing a major role in the death of these animals.

Hemoconcentration as evidenced by a rising erythrocyte count and hematocrit was a frequent finding following injection of strangulation fluid. This results in part from the pouring out of fluid into the peritoneal cavity following administration of the toxic material. It was also seen following intravenous injection of the fluid. Increased capillary permeability with resultant leakage of fluid from the intravascular spaces may have been a factor.

The prothrombin times, clotting times and platelet counts of these animals were not significantly altered, indicating no great impairment of the blood-clotting mechanism. Although the serum potassium level was increased in many animals, the importance of this change in the lethal issue was not great. Serum sodium changes were minimal.

REFERENCES

1. Barnett, W. O., Griffin, J. C. and Hardy, J. D. The efficacy of antibiotics combined with irrigation in experimental strangulation obstruction. *Surg., Gynec. & Obst.*, 106: 38, 1958.
2. Barnett, W. O. and Hardy, J. D. Observations concerning the peritoneal fluid in experimental strangulated intestinal obstruction; the effects of removal from the peritoneal cavity. *Surgery*, 43: 440, 1958.
3. Barnett, W. O. and Neeley, W. A. A comparison of in vivo changes following administration of strangulation obstruction fluid and Clostridium welchii toxin. *Surg., Gynec. & Obst.*, 106: 667, 1958.
4. Barnett, W. O. and Stanley, T. V. The treatment of experimental strangulation obstruction. To be published.
5. Barnett, W. O. and Turner, M. D. Effects of various alterations of peritoneal fluid resulting from experimental strangulated intestinal obstruction. *Surgery*, 43: 595, 1958.
6. Barnett, W. O. and Turner, M. D. Unpublished data.
7. Cohn, I. Bacterial factors in strangulation obstruction; review of experimental work. *Am. Surgeon*, 22: 836, 1956.
8. Dacie, J. V. The Hemolytic Anemias. London, 1954 J. & A. Churchill Ltd.
9. Tanturi, C. C., Anderson, R. B. and Canepa, J. F. Lecithinase and hyaluronidase in experimental intestinal obstruction. *Surg., Gynec. & Obst.*, 19: 171, 1950.

Observations on Posterior Dislocation of the Elbow Joint in Athletes

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In 1953 Lavine [1] reported a simple method for reduction of posterior dislocation of the elbow joint without anesthesia used successfully in seven cases. The method described is as follows: After administration of an appropriate analgesic, usually demerol® intravenously, the patient is seated in a straight back chair and the extremity gently placed in a comfortable position over the back of the chair, which has previously been padded. Gentle downward traction is made at the wrist by one of the operator's hands, while any lateral or medial displacement of the forearm is corrected with the other hand. (Fig. 1.) Reassurance of the patient and gentleness of manipulation were stressed, as well as the ease with which reduction was accomplished both in children and adults.

This method was adopted and, to date, seven posterior dislocations of the elbow joint, all seen within two hours after injury, have been easily reduced. One is impressed by the complete lack of additional trauma in effecting the reduction. Postoperatively, the extremity is placed in a padded posterior splint or long arm cast with the elbow joint at 80 degrees' flexion for a period of three weeks, followed by increasing active exercises and physiotherapy. Four of these patients were Army personnel in basic training and were followed up for a period of twelve weeks. All regained complete flexion and 165 degrees or better extension of the elbow joint; in only one was there minimal calcification in the collateral ligaments. Two were children, ages seven and eleven. In one there was an associated fracture of the medial epicondyle which necessitated open reduction. Both of these children obtained excellent results. In none was myositis ossificans noted.

The postoperative treatment of one of these cases is felt worthy of a more detailed report.

CASE REPORT

In the final game of the regular season, this player, a twenty year old quarterback, sustained a complete posterior dislocation of the right elbow

Fig. 1. Lavine method for reduction of posterior dislocation of the elbow joint.

FIG. 2. Thirty days after reduction. Note faint calcification in brachialis anticus muscle.

FIG. 4. Eighteen months following injury. Note absence of calcification in brachialis anticus. Also, note presence of calcification in collateral ligaments.

joint, with marked lateral displacement of the forearm. Although no x-ray was obtained, the physical findings of posterior dislocation of the elbow joint were obvious, and there was no question as to the correct diagnosis. There was no evidence of an associated fracture. In the dressing room, reduction was easily performed by the Lavine method within five minutes after injury, and the extremity was immobilized. Later x-rays revealed good reduction and no evidence of associated fracture. On the following day the team received and accepted a bid to play in a postseason bowl game five weeks hence. The athlete was told he most likely could not participate. However, the splint was removed in nine days and most of the edema and ecchymosis had subsided, although moderate tenderness persisted over the anterior and medial aspects of the joint. Increasing active exercises were instituted, progressing gradually to resistive exercises, together with short daily whirlpool and ultrasonic

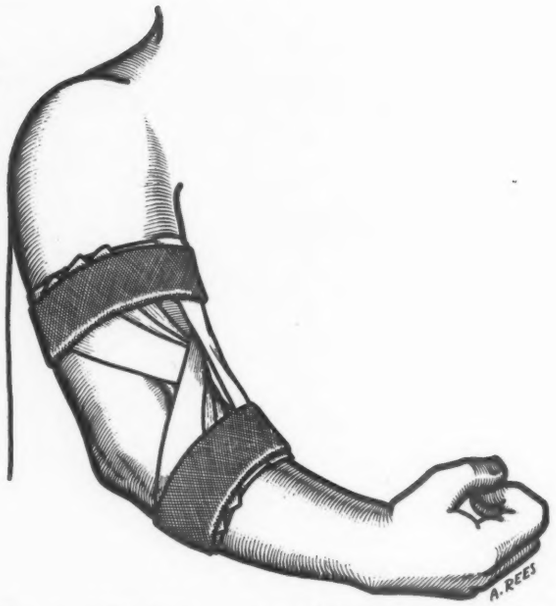

FIG. 3. Adhesive strapping designed to limit elbow extension to 150 degrees.

treatments. Twenty-one days following the dislocation, complete flexion and extension to 160 degrees had been obtained. The player was then fitted with an aluminum hinge brace with stop at 150 degrees and a short arm and longer forearm cuff. Since the patient was right-handed, he was unable to pass the football effectively while wearing the brace. However, thirty days following the injury recovery was considered complete. The joint was completely asymptomatic, with complete flexion and extension to 170 degrees. No atrophy of the arm or forearm muscles had resulted and there was no induration or tenderness. X-rays at this time were negative except for a 5 mm. area of faint calcification in the region of the brachialis anticus. (Fig. 2.) At this time the brace was discarded and an adhesive strapping was devised by the athletic trainer, which limited joint extension to 150 degrees, but which allowed him to pass the football effectively. (Fig. 3.) As proof of complete recovery, this player performed brilliantly for fifty-six minutes in the postseason encounter; he directed the team, gained 79 yards rushing, completed four of six passes for 67 yards and one touchdown, and scored two touchdowns himself. In addition, he was selected the game's most valuable player.

He has since had no further symptoms referable to the elbow joint. Examination twenty months following injury revealed a complete absence of pain or tenderness, with complete flexion and extension to 170 degrees. X-rays revealed no evidence of degenerative changes in the joint. Three small areas of calcification were noted in the region of the lateral collateral ligament and one in the medial collateral ligament. (Fig. 4.)

COMMENTS

In the treatment of athletes, both professional and amateur, it is the entire responsibility of the team physician to protect the player from the possibility of permanent injury, but at the same time every effort should be made to facilitate recovery in the shortest possible time. In this particular case, complete recovery from a posterior dislocation of the elbow joint in thirty days is attributed to the extremely short interval between the time of dislocation and reduction (five minutes), as well as the lack of additional trauma in effecting the reduction. This undoubtedly accounts for the minimum amount of edema and hemorrhage which ensued. It is therefore believed that team physicians, when present at athletic contests or within a short distance from the practice field, should not delay reduction of the dislocated elbow for transportation to the hospital, x-rays and anesthesia. This is believed to be true even in cases with associated fracture, since the reduction should be effected prior to treatment of the fracture [2]. The third factor to which this rapid recovery is attributed is the early discontinuance of immobilization (nine days) and the institution of progressively increasing active exercises, together with physiotherapy. Loomis [3] in 1944, in reporting nineteen cases, stressed the additional trauma inflicted in the usual method of reduction by extension, hyperextension, traction and flexion.

Also, from this experience, it is believed that reduction carried out without delay and with a minimum of trauma, as provided by the Lavine method, is a most important factor in the ultimate prevention of myositis ossificans and the recovery of joint motion. The local injection of hyaluronidase into the hematoma, as advocated by MacAusland and associates [4], and the use of intramuscular aqueous trypsin would seem to be of value in the prevention of myositis ossificans. Neither of these drugs was used in this particular case, however.

SUMMARY

1. The method for reduction of posterior dislocation of the elbow joint, as advocated by Lavine, has been found to be successful, expedient and simple to perform, is atraumatic, and requires neither anesthesia nor assistance.

2. A case of posterior dislocation of the elbow joint in a football player, with complete recovery and rehabilitation within thirty days, is presented.

3. A method of adhesive strapping of the elbow joint for athletes which affords satisfactory protection and at the same time allows maximum function is described.

4. Evidence is presented that early and atraumatic reduction, which reduces hemorrhage and edema to a minimum, is an important factor in the prevention of traumatic myositis ossificans.

Acknowledgment: I wish to express my sincere appreciation to Mr. Joe Worden, trainer for the athletics teams of Vanderbilt University, for his invaluable assistance in the care of athletic injuries at the University.

REFERENCES

1. Lavine, L. S. A simple method of reducing dislocations of the elbow joint. *J. Bone & Joint Surg.*, 35-A; 785–786, 1953.
2. Key, J. A. and Conwell, H. E. Fractures, Dislocations and Sprains, 6th ed., p. 518. St. Louis, 1956. C. V. Mosby.
3. Loomis, L. K. Reduction and after-treatment of posterior dislocation of the elbow. *Am. J. Surg.*, 63; 56–60, 1944.
4. MacAusland, W. R., Gartland, J. J. and Hallock, H. The use of hyaluronidase in orthopaedic surgery. *J. Bone & Joint Surg.*, 35-A; 605–608, 1953.

The Incidence of Congenital Anomalies Discovered in the Neonatal Period

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CONGENITAL anomalies have become increasingly important as a cause of neonatal death. Baumgartner [1] and Ingalls [2] state that these anomalies are the second ranking cause of death in the first year of life and are surpassed only by prematurity.

This study is a review of 30,398 consecutive live births at the Kings County, Carson C. Peck Memorial and St. Mary's Hospitals in Brooklyn, New York, from January 1, 1952 to December 31, 1955. We undertook this study to establish the incidence of congenital anomalies discovered in the neonatal period in this community. The method used was a review of the infants' hospital charts which covered the period from birth to five to seven days of age. This method seemed to be more reliable than the collection of data from birth certificates which are recorded in the first twenty-four hours of life.

In this series 2 per cent of the infants died in the neonatal period. Sixty-six per cent of these deaths followed premature births, and in 10 per cent of these cases congenital anomalies were also present. Twenty-six per cent of the full term infants who died had congenital anomalies.

ETIOLOGY

Many factors have been implicated as causes of congenital anomalies. A tendency toward the hereditary transmission of certain malformations is well established. Syndactylia, brachydactylia, arachnodactyly, osteogenesis imperfecta and achondroplasia [3] show a clear-cut hereditary influence. Cleft lip and palate show a less marked hereditary factor. Baxter [4] states that if one parent or one child in a family has a cleft lip and/or palate, there is a 5 per cent probability that any future child will have the defect. If one parent and one child have the deformity, there is a 15 per cent chance that any future child will also have it. Infants with major anomalies of the central nervous system, serious cardiac anomalies and major gastrointestinal anomalies frequently succumb in the neonatal period and these diseases are therefore not transmitted.

In 1941 Gregg [5] associated the occurrence of congenital cataracts with maternal rubella in the first trimester of pregnancy. In 1943 Swan et al. [6] incriminated maternal rubella as a cause of congenital heart disease, anomalies of the central nervous system and deafness. Other viral diseases in early pregnancy may cause anomalies but no set pattern of defects has been demonstrated [7]. Toxoplasmosis [8] during pregnancy may cause hydrocephaly and other abnormalities of the central nervous system. Congenital syphilis has well known effects on the child.

Ingalls et al. [9] believe that anoxia in the first trimester of pregnancy can cause anomalies. Maternal trauma, anesthesia, chronic disease or high altitude are possible factors in such anoxia. The importance of uterine bleeding in the first trimester has been equivocal. Burge [10] found an 8.6 per cent incidence of bleeding in the mothers of 289 children with congenital anomalies and he believes that

Congenital Anomalies

TABLE 1
CONGENITAL ANOMALIES

Anomaly	White Patients	Negro Patients	Total	Incidence per 1,000 Live Births
Musculoskeletal system:				
Polydactylia	9	78	87	2.88
Syndactylia	5	2	7	0.23
Adactylia	2	1	3	0.09
Clubfoot	70	53	123	4.05
Dislocation of hip	4	2	6	0.19
Other skeletal anomalies	7	3	10	0.33
Cleft palate	16	8	24	0.79
Cleft lip	6	3	9	0.29
Cleft lip and palate	10	5	15	0.49
Total cleft palate	26	13	39	1.28
Total cleft lip	16	8	24	0.79
Congenital heart disease	19	12	31	1.02
Central nervous system:				
Hydrocephaly	11	4	15	0.49
Meningocele	29	2	31	1.02
Spina bifida	6	2	8	0.26
Anencephalia	4	2	6	0.19
Mongolism	13	3	16	0.52
Genitourinary tract:				
Hypospadias	19	9	28	0.92
Hydrocele	11	5	16	0.52
Polycystic kidney	2	2	4	0.13
Gastrointestinal tract:				
Imperforate anus	4	2	6	0.19
Tracheoesophageal fistula	3	3	6	0.19
Diaphragmatic hernia	1	2	3	0.09
Atresia or stenosis of bowel	1	3	4	0.13
Volvulus	1		1	0.03
Annular pancreas	1	1	2	0.07
Hernias:				
Inguinal	3	15	18	0.59
Umbilical	3	35	38	1.25
Skin:				
Hemangiomas	11	9	20	.65
Icthyosis	1		1	0.03
Ranula	2	1	3	0.09
Totals	316	288	604	19.9/1,000

bleeding is not a causative factor. In our series bleeding in the first trimester was reported in less than 8 per cent of the cases.

Radiation [*11*] during the first trimester of pregnancy has been reported as a cause of anomalies.

Warkany et al. [*12*] have been able to produce anomalies in rats by depriving the pregnant rat of certain vitamins. Vitamin D deficiency caused bowing of the legs. Vitamin A deficiency caused anomalies of the eye, heart and genitourinary organs. Riboflavin deficiency was followed by skeletal deformities such as cleft palate, micrognathia, syndactylia and shortening of the long bones.

Peer and Strean [*13*] believe that severe emotional stress in early pregnancy is a causative factor in the production of cleft lip and cleft palate by the increased secretion of cortisone during periods of stress. They have produced cleft lip in the mouse by giving hydrocortisone to the pregnant female.

Polyhydramnios is mentioned as an associated factor in the occurrence of congenital malformations. Prindle et al. [*14*] found that sixty-three of sixty-eight defective infants

born to mothers with polyhydramnios had hydrocephaly, anencephalia or spina bifida. Polyhydramnios occurred in 1.2 per cent of the mothers of malformed infants in our study.

FINDINGS

Of the infants in this survey, 47.1 per cent were white and 52.9 per cent were Negroes.

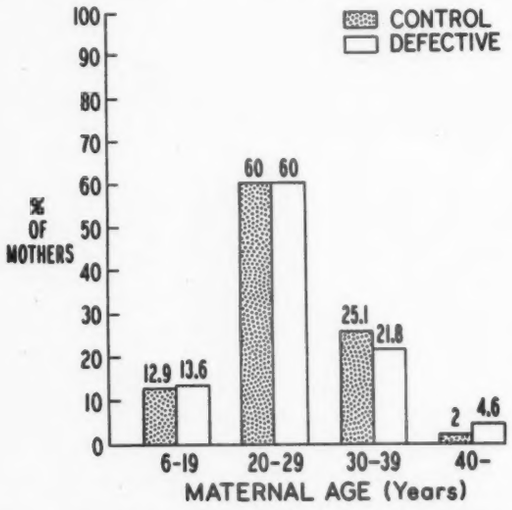

FIG. 1. Graph demonstrates that the incidence of anomalies and the incidence of live births is equivalent for various age groups.

The nearly equal numbers in each group provided an opportunity for comparison of the incidence of anomalies in each group. Murphy [*15*] and others have reported that congenital malformations are more frequent in the white race than in the Negro race, at a ratio of 2:1. This ratio was confirmed in the present study with the notable exception of polydactylia and congenital hernias. The two latter conditions were more frequent in Negroes. (Table 1.)

Most reports on congenital anomalies state that parity of the mother does not seem to influence the incidence of anomalies. This opinion is confirmed by the data which follow: Twenty-nine per cent of the children with congenital anomalies were born of a first pregnancy, 56 per cent of a second to fifth pregnancy and 15 per cent of a fifth or later pregnancy. In the total series of 30,398 births, 27 per cent of the children were of a first pregnancy, 61 per cent of a second to fifth pregnancy, and 12 per cent of a fifth or later pregnancy. Penrose [*16*] believes that maternal age rather than birth rank is a significant factor in the occurrence of anomalies.

Murphy [*15*] states that the proportion of malformed to normal children remains constant in births to mothers whose ages are between fifteen and twenty-nine, but increases after the mother is thirty years of age. This study did not confirm this opinion. In 1954 (the mid-point of this study) 70.4 per cent of births in the United States were to mothers under thirty years of age, 27.4 per cent to mothers thirty to forty years of age, and 2.2 per cent to mothers over forty. In this series (Fig. 1) 72.9 per cent of the mothers were under thirty years of age, 25.1 per cent were thirty to forty years of age and 2 per cent were over forty years of age. In the group of children with anomalies 73.6 per cent were from mothers under thirty years of age, 21.8 per cent were from mothers thirty to forty years of age and 4.6 per cent were from mothers over forty years of age. Mongoloid infants were an exception in that 73.5 per cent of them were born to mothers over thirty-five years of age.

Congenital defects were found in 604 of 30,398 live births. Thus the incidence of anomalies was approximately one in every fifty live births or a rate of 19.9 per 1,000. Hendricks [*17*] reported an incidence of one anomaly in 140 live births, and Wallace [*18*] reported one anomaly in 109 live births. However, these statistics were derived from birth certificates.

The anomaly which showed the most marked racial preference in this series was polydactylia. Polydactylia was discovered in eighty-six babies, for an incidence of 2.88 per 1,000 live births. In white children the rate was 0.63 per 1,000 but in Negro children it was 4.87 per 1,000. Wallace [*18*] reported a total incidence of polydactylia, syndactylia and adactylia of 1.2 per 1,000, compared with our findings of 3.2 per 1,000 live births.

The most common abnormality in this study was clubfoot. Equinovarus deformity was the most frequently diagnosed condition of the four variations reported. One hundred twenty-three cases of clubfoot in 30,398 live births gave an incidence of 4.05 per 1,000. Other skeletal anomalies included dislocation of the hip, flail knee, pigeon breast, achondroplasia, osteogenesis imperfecta, osseous dysplasia and absence of bones.

The incidence of cleft lip and cleft palate was of particular interest to us. In this series cleft palate without cleft lip occurred at a rate of 0.79 per 1,000 live births. The total incidence

of cleft palate was 1.28 per 1,000, or one in 780 live births. Slaughter and Brodie [*19*] reported the incidence of cleft palate in the United States as one in 770 live births. The total incidence of cleft lip in our series was 0.79 per 1,000, or one in 1,266 live births. Cleft lip and/or cleft palate occurred at a rate of 1.6 per 1,000, or one in 633 live births. This figure is consistent with the study of Fogh-Anderson [*20*], who reported an incidence of one cleft in 665 births in Denmark.

The ratio of white to Negro infants with these clefts was 2:1. Of the cleft lips, 60 per cent involved the left side only, 30 per cent the right side only and 10 per cent were bilateral. The Pierre Robin syndrome was seen once in each 10,000 live births. Twenty-three per cent of the infants with clefts had other anomalies. Holdsworth [*21*] reported a 20 per cent incidence of multiple anomalies associated with cleft lips and palates. In our series 35 per cent of the clefts occurred in infants born of a first pregnancy.

Congenital heart disease was recorded thirty-one times, or at a rate of 1.02 per 1,000.

Anomalies of the central nervous system were four times more common in white than in Negro infants. Meningocele, spina bifida and hydrocephaly often occurred together. Mongolism was recorded at a rate of 0.52 per 1,000, or once in approximately 2,000 live births.

Gastrointestinal anomalies were found in twenty-two infants. This was a ratio of 0.73 per 1,000 live births. Tracheoesophageal fistula and imperforate anus were the most frequent malformations of the gastrointestinal tract. There were equal numbers of Negro and white infants with anomalies of this organ system.

The most frequent genitourinary anomalies were hypospadias and hydrocele. Polycystic kidneys reported were discovered at postmortem examination.

Inguinal hernias were five times more frequent in Negro than in white infants. They were 4.5 times more frequent in males than in females. Umbilical hernias were nine times more common in Negro than in white infants and also nine times more frequent in females than in males.

Hemangiomas were discovered once in 1,500 live births. A study of infants for longer than the first week of life would probably have demonstrated a greater incidence than this.

Five per cent of the children with anomalies in this series had more than one anomaly.

It should be stated that congenital dislocation of the hip, pyloric stenosis, angiomas and mongolism may not be clearly manifest in the first week of life and that their incidence is probably underestimated in the review. A similar situation exists with respect to some congenital cardiovascular deformities of the acyanotic group. The exclusion of stillbirths from the series has eliminated some anomalies, particularly those of the central nervous system.

SUMMARY AND CONCLUSIONS

1. A consecutive series of 30,398 live births in Brooklyn has been reviewed. One congenital anomaly was found in every fifty live births. The number of previous pregnancies of the mother did not seem to be a factor in the incidence of anomalies. Only in the case of mongolism did the age of the mother seem to be significant. The majority of mothers of mongoloid infants were over thirty-five years of age.

2. There was a relatively low incidence of uterine bleeding during pregnancies which resulted in abnormal infants (8 per cent).

3. Of the infants who died in the neonatal period, 15.4 per cent had congenital anomalies.

4. Polyhydramnios was frequent in the mothers of infants who had anomalies of the central nervous system.

5. The most frequent anomaly was polydactylism in the Negro. This abnormality was nine times more frequent in the Negro than in the white infant.

6. Inguinal and umbilical hernias were also more common in Negro children than in white children, the former at a ratio of 5:1 and the latter at a ratio of 9:1.

7. Although most anomalies were more frequent in males than in females (at a ratio of 3:2), umbilical hernias were more frequent in females than in males (at a ratio of 9:1).

8. Cleft palate, cleft lip, clubfoot, congenital heart disease and genitourinary anomalies were approximately twice as frequent in white children than in Negro children. Anomalies of the central nervous system were approximately four times more frequent in white children.

REFERENCES

1. Baumgartner, L. Infant and childhood mortality in the United States in 1947. *Pediatrics*, 3: 722–728, 1949.
2. Ingalls, T. H. The study of congenital anomalies by the experimental method. *New England J. Med.*, 243: 67–74, 1950.

3. Syonsby, A. Clinical Genetics. St. Louis, 1953. C. V. Mosby Co.
4. Baxter, H. and Fraser, F. C. Familial distribution of congenital clefts of lip and palate. *Am. J. Surg.*, 87: 656–659, 1954.
5. Gregg, N. McA. Congenital cataract following German measles in the mother. *Tr. Ophth. Soc. Australia*, 3: 35, 1941.
6. Swan, C., Tostevin, A. L., Mayo, H. and Black, G. H. B. Congenital defects in infants following infectious diseases during pregnancy, with special reference to relationship between German measles and cataract, deaf mutism, heart disease, and microcephaly, and to period of pregnancy in which occurrence of rubella is followed by congenital abnormalities. *M. J. Australia*, 2: 201–210, 1943.
7. Kaye, B. M., Rasner, D. C. and Stein, A. Viral diseases in pregnancy and their effect upon the embryo and fetus. *Am. J. Obst. & Gynec.*, 65: 109–119, 1953.
8. Wolf, A., Carmen, D. and Paige, B. Prenatal inception of infantile toxoplasmosis. *Science*, 93: 548, 1941.
9. Ingalls, T. H., Curley, F. J. and Prindle, R. A. The experimental production of congenital anomalies. *New England J. Med.*, 247: 758–768, 1952.
10. Burge, E. S. The relationship of the threatened abortion to fetal abnormalities. *Am. J. Obst. & Gynec.*, 61: 615–621, 1951.
11. Goldstein, L. and Murphy, D. P. 1. Etiology of the ill-health in children born after maternal radiation. 11. Defective children born after post-conception pelvic irradiation. *Am. J. Roentgenol.*, 22: 322–333, 1929.
12. Warkany, J., Nelson, R. C. and Schroffenberger, E. Congenital malformations induced on rats by maternal nutritional deficiency. *Am. J. Dis. Child.*, 65: 882–894, 1943.
13. Peer, L. A. and Strean, L. P. Stress as an etiologic factor in the development of cleft palate. *Plast. & Reconstruct. Surg.*, 18: 1–8, 1956.
14. Prindle, R. A., Ingalls, T. H. and Kirkwood, S. B. Maternal hydramnios and congenital anomalies of the central nervous system. *New England J. Med.*, 252: 555–556, 1955.
15. Murphy, D. P. Congenital Malformations, 2nd ed. Philadelphia, 1947. J. B. Lippincott Co.
16. Penrose, L. S. The Biology of the Mental Defect. New York, 1949. Grune & Stratton, Inc.
17. Hendricks, C. H. Congenital malformations; analysis of the 1943 Ohio records. *Obst. & Gynec.*, 6: 592–598, 1955.
18. Wallace, H. M., Baumgartner, L. and Rich, H. Congenital malformations and birth injuries in New York City. *Pediatrics*, 12: 525–535, 1953.
19. Slaughter, W. B. and Brodie, A. G. Facial clefts and their surgical management. *Plast. & Reconstruct. Surg.*, 4: 311, 1949.
20. Fogh-Anderson, P. Inheritance of Harelip and Cleft Palate. Copenhagen, 1942. Arnold Busch.
21. Holdsworth, W. G. Cleft Lip and Palate. New York, 1953. Grune & Stratton, Inc.

Office Ligation of Internal Hemorrhoids

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SEVERAL years ago I presented a method and technic in application of a new concept for the treatment of internal hemorrhoids which avoided the necessity of hospitalization.* On the basis of several years of clinical experience since that time it is now possible to report more fully on various aspects of this method.

When one considers the indisputable fact that internal hemorrhoids frequently occur independently of other anal disorders, are readily accessible and practically devoid of pain sense, it seems surprising that an adequate means of office treatment had not been devised long ago. Here is an ideal and altogether unparalleled combination of circumstances consonant with office management. Insensitivity in itself represents an extraordinary opportunity for the widest possible scope in an office procedure, and I can think of no other unfeeling area in the body associated with such readily attainable external accessibility.

This new concept of treatment was devised for a substantially large group of patients whose sole or chief symptom was bleeding ascribable to the internal hemorrhoids and who had comparatively little or no other surgically significant anal disorders. Here the circumstances are often less than would seem to justify hospital surgery. Particularly when only small amounts or isolated episodes of bleeding are concerned it is hard to convince patients and even oneself that hospitalization with all it implies in expense and disability should be necessary. Even with more marked bleeding, with or without some degree of prolapse, there is often warranted resistance or reservation to radical surgery. Considerations of age and general health, economic circumstances, employment and convenience may be determining factors, and yet previously the only alternative to hospital surgery was the injection treatment which has admittedly never held prospect of permanent and really satisfactory results. Pain and annoying tenderness or a history of acute attacks on the subjective side, and substantial prolapse and the presence of external hemorrhoidal tissue, objectively, mark a sharp dividing line in indication between office and hospital care both psychologically to the patient and from the standpoint of proper disposition of the existing disorder.

Basically my method effects the standard ligature method of hemorrhoidectomy except that it is performed with instruments especially adapted to office use and restricted as stated to the internal hemorrhoids. Thus it combines the advantages of a simple office procedure with the permanency resulting from actual destruction of tissue, heretofore the exclusive province of hospital surgery. After sharp dissection of the external hemorrhoidal element in the classic ligature operation, a pedicle is formed above the remaining internal hemorrhoid by means of a ligature. Substantially the very same tissue structure is ligated as in our office procedure. The two methods differ then as far as the *internal* hemorrhoid is concerned only in the subsequent scalping of tissue distal to the ligature. Even with such scalping (in the hospital operation) a substantial amount of tissue must be left to slough so that the ligature will not slip off. Any difference then actually becomes largely academic, again as far as the internal hemorrhoid is concerned.

TECHNIC

The method is planned around a special instrument (Figs. 1 and 2) introduced through an anoscope and by means of which any desired portion of the grasped internal hemorrhoid is pulled through a small metal ring. (Figs. 3 and 4.) With the hemorrhoid locked in this position a pre-set slip noose is extruded over the upper edge of the encircling ring and tightened to form a pedicle of tissue proximal to the

* Scientific exhibit, A. M. A. Convention, 1954.

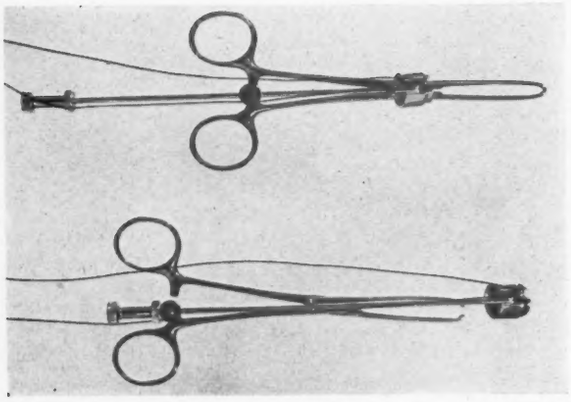

FIG. 1. Principal instrument used for office ligations of internal hemorrhoids. Shows instrument in grasping position and again in position as it would be after hemorrhoid is pulled through the ring.

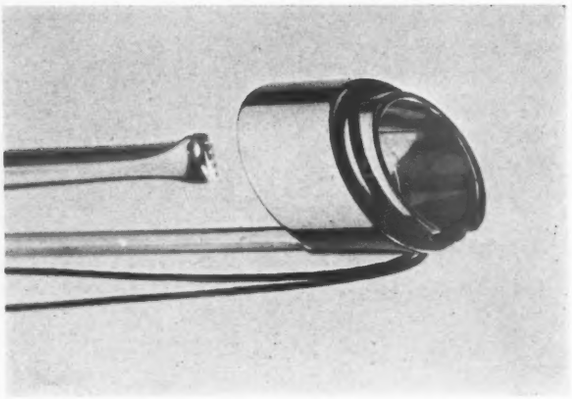

FIG. 2. Enlarged view of head of ligating instrument, showing slip noose over inner ring. Knurled nut at other end of instrument activates outer ring which slides upward, thus freeing the slip noose.

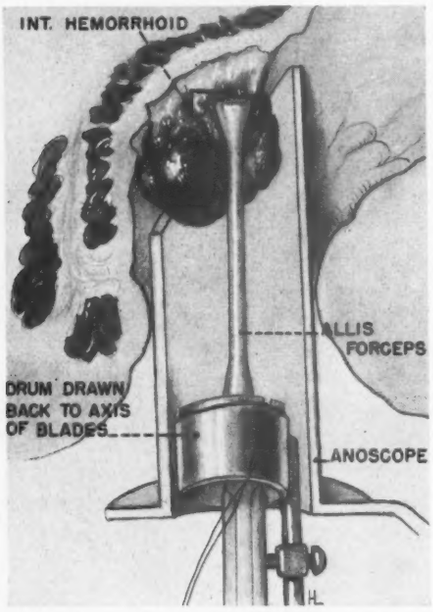

FIG. 3. Ligating instrument introduced through an anoscope grasps internal hemorrhoid. A headlight is used for illumination.

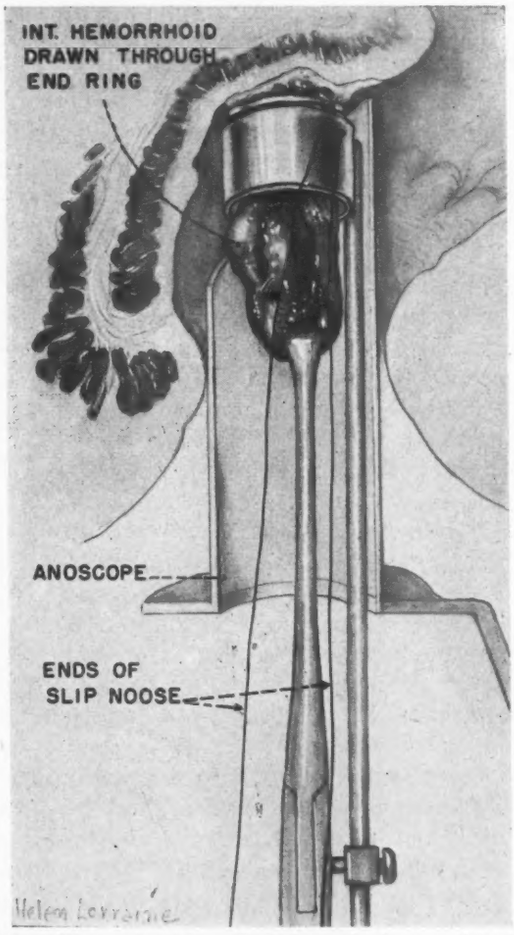

FIG. 4. Hemorrhoid is pulled through rings and locked in this position.

hemorrhoidal tissue pulled through. (Fig. 5.) This is all quite painless unless there is encroachment into the transitional area. The instrument is then withdrawn and the slip noose locked with an additional knot.

Various modifications and additional steps have been tried such as momentary clamping of the formed pedicle followed by immediate application of an additional tie or, again, by ballooning the ligated hemorrhoid with irritating or non-irritating liquids. Some of these maneuvers have actually been too effective in producing rapid large slough with undesirable, although in our experience not serious, tendency toward discomfort and bleeding. The area of any such slough is of course sharply and advantageously controlled and demarcated by

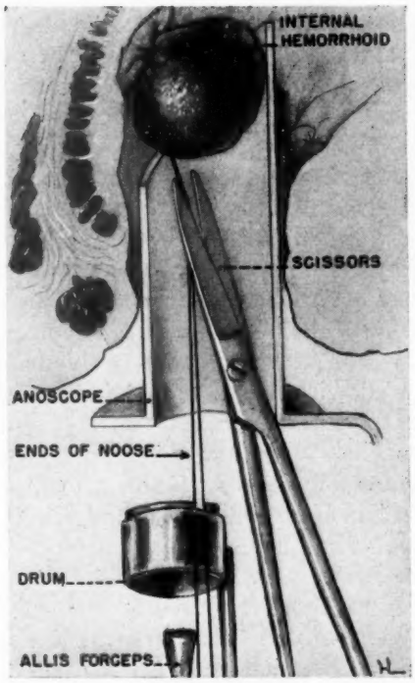

FIG. 5. Slip knot has been tightened and ligating instrument is being withdrawn. Slip knot is usually locked with an additional knot by means of tonsil tier.

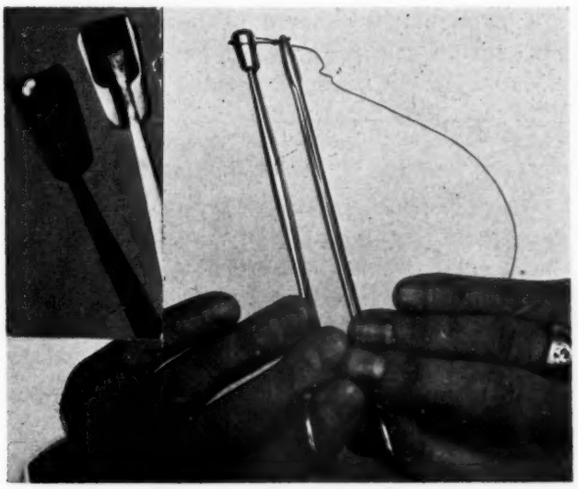

FIG. 6. Useful instrument for tying oozing sloughing area to prevent postoperative bleeding, actually rarely necessary. The regular ligating instrument or ordinary Murphy hemostat may also be used for the purpose. This illustration is included particularly to show proper technic for handling instruments for all anoscopic work for least obstruction to vision by fingers and hands.

the ligature, and yet we have come to prefer simple ligations as described, repeated as needed for more gradually induced effects.

COMPLICATIONS

Whenever there is destruction of living tissue there are inherently potential hazards and complications. This is true no matter what the instrumentality or mode of destruction, be it by injection of sclerosing solution, by cautery, diathermy, sharp dissection, or by constriction of the blood supply. That there is no difference, too, whether it is accomplished in the hospital or in the office should be understood by the patient.

Early in my experience with ligation of internal hemorrhoids several instances of delayed bleeding proved troublesome. Once the patient reported to the office, however, control of such bleeding was of little problem because as with the original treatment no anesthesia was necessary for ready exposure. Without discomfort to the patient the bleeding point could be readily secured through an anoscope and tied off. The instrument I developed proved useful for the purpose. (Fig. 6.) Here was a distinct and obvious advantage over the same complication following hospital surgery because of the always painful postoperative wounds. Even so, and even while such uncommon bleeding was well within the bounds of reasonable safety, the occasions might be too inopportune to regard with satisfied complacence.

Fortunately this problem of bleeding was fully solved. The key lay in the fact that as with hospital surgery true secondary bleeding never occurred before the seventh postoperative day. (Earlier bleeding is not unknown after hospital surgery due to ties on bleeders slipping off, a non-existent circumstance here.) Thereafter, it was always arranged to see patients again before the expiration of this time. It was noted that troublesome bleeding, if any, occurred only at the stage of sloughing of dead tissue which explains the seven-day interval. Without sloughing of dead tissue, before sloughing or in connection with granulating wounds after sloughing there might be oozing of blood, but it never progressed to the point of disturbing concern. Therefore, at this second visit a hemostatic tie was placed on any sloughing area which tended to ooze. Actually this has rarely proved necessary but by employing it in those few instances we have had no subsequent secondary hemorrhages.

In passing, the implications of sloughing as revealed by my observations led to suggestions reported elsewhere for prevention of massive hemorrhage secondary to hospital hemorrhoidectomy. While the details of the latter do

not particularly concern us here it might be noted that the approach necessarily differed because of the impracticability of intra-anal exposure postoperatively.

RESULTS

The effects of ligation as described can be controlled to the extent of three quite distinct end results. While there are no sharp demarcations between these, one can achieve for practical purposes the desired stage. The latter are advanced progressively by inclusion of increased amounts of tissue to be ligated and/or the number of ligations employed.

Thus a single absorbable ligature confined to a small bleeding area will accomplish the same thing as anywhere else in surgery, namely, immediate control of bleeding. As a limited objective this is obviously useful for its own sake, for not infrequently active spontaneous bleeding is encountered in proctological practice. Such an objective may constitute an end in itself as, for example, in the aged or infirm; or, again, it may serve in tiding a patient over for subsequent hospital surgery at a more propitious or convenient time. With inclusion of larger amounts of hemorrhoidal tissue, and in some instances an additional ligation several days later, a fibrosing effect short of any actual sloughing is obtained with subsequent contraction and decrease of vascularity. This would patently have a more lasting effect than the single hemostatic ligature but is still short of what is possible and feasible. I have treated patients with even continuous prolapse who have been so satisfied with the results at this stage that they preferred a "wait and see" policy and have not returned to the time of this report. As a rule, I have not been satisfied with this end result and prefer to extend treatment to actual tissue destruction.

There is no question but that any amount of hemorrhoidal tissue can be permanently destroyed in this manner as completely as by any other surgical procedure. When one views the clean granulating wound or subsequent healed areas remaining after ligations he would be unable to differentiate them from the result obtained by cutting instruments.

There is one disadvantage to the method which should be mentioned in comparing it to hospital surgery: the practical limits of applicability vary inversely with the amount of tissue to be destroyed. In the operating room it is just as expeditious to remove large hemorrhoids as small, while with larger hemorrhoids and a substantial degree of prolapse office treatment becomes concomitantly more extended. Here the inconvenience of more office visits must be weighed against the alternative of concentrated hospital time. There are some patients, for example, who have sick leave and hospital insurance coverage and others who cannot spare the time but who can arrange for short office calls. The actual time consumed by each ligation constitutes no problem in itself, being well within five minutes in experienced hands. By and large the matter of indication is determined by whether eradication of internal hemorrhoids present fulfills the requirement for relief in any given case and whether this can be accomplished with reasonable effort. This decision is rarely difficult. This method has been a constant source of real satisfaction to me not only in cases in which objectives and choice of treatment are to some degree optional but also in a larger group of patients for whom no other treatment is so ideally suited from the standpoint of permanent results without the necessity of hospital surgery.

I have employed this new method for about five years using reasonable care in the proper selection of cases. In not a single instance has subsequent hospital surgery become necessary in obtaining a satisfactory result for the patient. Its success in borderline cases constitutes suggestive evidence to me that the importance of radical dissection of external hemorrhoids may perhaps be overestimated.

SUMMARY

Occlusion of the blood supply to internal hemorrhoids by means of ligation is a practically painless procedure which can produce a controllable graded effect ranging from immediate arrest of bleeding to destruction of the hemorrhoid. The method is particularly useful when the sole symptom is rectal bleeding ascribable to internal hemorrhoids and the circumstances are less than would seem to justify hospital surgery. The permanency achievable is the same which accompanies destruction of pathological tissue by any surgical method or means. Herein lies its great advantage over the palliative injection treatment which heretofore has constituted the only alternative to hospital surgery. There has been no unpreventable complication.

Pilonidal Disease

A STUDY OF FIFTY CONSECUTIVE CASES TREATED SUCCESSFULLY BY EXCISION AND PRIMARY CLOSURE

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THE purpose of this article is to describe in detail the management and operative technic employed in fifty consecutive patients with postanal pilonidal disease, whose operative wounds healed after excision by primary union. Previously, dissatisfaction with other methods of management and operative technics influenced me to seek a change. This change took the form of a studied effort to avoid infection in the operative wound, and the successful results in the present cases can probably be attributed to this effort. The methods employed were formulated after I was convinced that so called "recurrences" are not due to failure to remove diseased tissue, but actually are due to infection within the operative wound preventing primary healing. This concept was first formulated by Rogers [*1*] in 1933, who showed that excised recurrent pilonidal sinuses rarely contained epithelial elements and that infection of the dead space left after excision was the real cause of "recurrences." The material of Patey and Scarff [*2*], Dwight [*3*] and my own examination of twenty-three excised "recurrent" sinuses substantiate this important basic concept. Some of these observations lend support to the acquired theory of etiology of pilonidal disease which has gained so much support recently by the significant contributions of Patey and Scarff [*2,4*], Joseph and Gifford [*5,6*], Davage [*7*], and Patey and Williams [*8*]. Regardless of etiology, excision of the diseased tissue and primary healing is probably the most desirable goal. The benefits resulting from successful primary closure include the lack of postoperative bleeding, the avoidance of prolonged dressings, the short healing time and the absence of tender scars. That these aims and benefits have not always been attained accounts for the adoption of other methods, such as open treatment and marsupialization. The main disadvantages of these other methods are the prolonged healing time and the need for frequent dressings.

If the conclusion is correct that recurrences are actually infections of the wound, it may be postulated that primary healing after excision of pilonidal lesions will occur if infection is prevented. Two questions are now germaine: Why does infection occur? What measures can be taken to prevent infections?

Cause of Infection. There are anatomical reasons for contamination of wounds after excision of pilonidal disease. The disease itself carries infection as part of the clinical picture. The anus is in close proximity and the feces keep the area covered with a profusion and variety of organisms. The area is usually very hairy and is difficult to reach so that there is often poor hygiene of the skin. The overhang of the buttocks, especially in obese patients, who constitute a large percentage of the patients with pilonidal disease, interferes with good wound closure and sometimes prevents evaporation from surrounding skin surfaces. Postoperatively wounds are subject to trauma because of location over bone and to contamination from feces. In view of all these factors it is not surprising that surgical wounds of this area are unique in their propensity to become contaminated, to become infected and to fail to heal. It is this *bete nôire* of infection that has doomed so many operations of excision and primary closure to failure. On the false assumption that recurrences are due to inadequate removal of tissue, wide excisions have often been proposed, making for greater difficulty in

closure with resulting dead space and tension, factors known to promote infection. Complicated flap operations for elimination of dead space have not been the answer either, because they open tissue spaces widely to contamination.

Avoidance of Infection. It has been my experience that if infection can be avoided in wounds closed after excision of pilonidal disease, primary healing will occur in the same manner as in clean wounds elsewhere in the body. Unfortunately, the nature of the disease may not permit avoidance of contamination to the same degree as do non-infected lesions elsewhere. Fortunately, some local tissue immunity to contaminating pathogenic organisms can be assumed, particularly in the presence of a chronically draining sinus. Contamination from the sinus itself can in nearly all instances be avoided in the technic to be described. Other requirements to avoid infection belong in the category of observing fundamental surgical principles. They include the following: (1) The maximum width of tissue to be removed should not exceed 2 cm. Rogers [*1*] has shown that over 70 per cent of lesions are simple midline structures which can be removed by excision of a piece of tissue no larger than 2 cm. wide, 2 cm. deep and 5 cm. long. Large diseased areas can be reduced to this size by preliminary incision. Removal of a narrow width of tissue favors easy closure. (2) Contamination from the sinus tract and other sources must be avoided. (3) There must be meticulous hemostasis. (4) Dead space should be obliterated. (5) Closure should be accomplished without tension.

It is clear that requirements 4 and 5 are natural sequelae of 1. Unless the surgeon is willing and able to fulfill these requirements, I believe that primary closure should be abandoned in favor of an open operation, preferably marsupialization (Phillips [*9*], Phelan [*10*]). Fortunately, the procedures to be described have permitted the fulfillment of these requirements in an area where the obstacles are considerable.

TECHNIC OF EXCISION AND PRIMARY CLOSURE

The technic is in reality a simplification of the standard excision and closure procedures, as well as a refinement of the means by which infection is prevented. The method has been employed in fifty consecutive cases during a period of eleven years. The operations were all performed by the author, and the technic has remained essentially unchanged during this time. Minor changes have evolved in both pre- and postoperative care.

Preliminary Surgery. This is required under two conditions. (1) If there is an abscess or if more infection is present than would be expected in a chronically draining sinus, vertical, preferably midline, incision is made and adequate drainage provided. (2) If there is a complicated tract with multiple openings or it is thought that the diseased tissue cannot be removed in a 2 cm. wide block, a groove director is inserted into the sinus tract or tracts, the overlying skin and subcutaneous tissue is incised, and the wound is packed open. Incision and drainage is to be considered part of the preparation for definitive surgery, which in this instance is a two-stage operation. Most often it can be accomplished in the office under local anesthesia. At times hospitalization and general anesthesia is required. Preliminary incision and drainage clear up acute infection, reducing the abscess to a chronic sinus or resulting sometimes in closure of the tract. Moreover, the resulting scar contracts the swollen tissue to a reduced volume, drawing it to or toward the midline so that a minimum of tissue will have to be excised at the second stage. The time between operations should be five to six weeks.

Preoperative Preparation. Five days before definitive surgery the patient is given 2 gm. of sulfasuxidine® orally four times daily to reduce intestinal bacteria. Two days before surgery a low residue diet is begun to reduce stool volume. Cleansing enemas are given the night before surgery. After stool has been evacuated and the sacrococcygeal area shaved, the patient is required to bathe and cleanse well the sacrococcygeal and rectal areas. The cleansing bath is repeated the morning of surgery.

Operation. Because I believe attention to detail is of paramount importance in the successful eradication of pilonidal disease, the surgical technic is being described at considerable length. Failure to observe one of the steps may jeopardize the chance to obtain primary wound healing, the *sine qua non* for prevention of "recurrence."

Anesthesia. General anesthesia with a clear airway is preferred. Local infiltration anesthesia has the disadvantages of distorting tissues, of not relaxing muscles, and of potentially

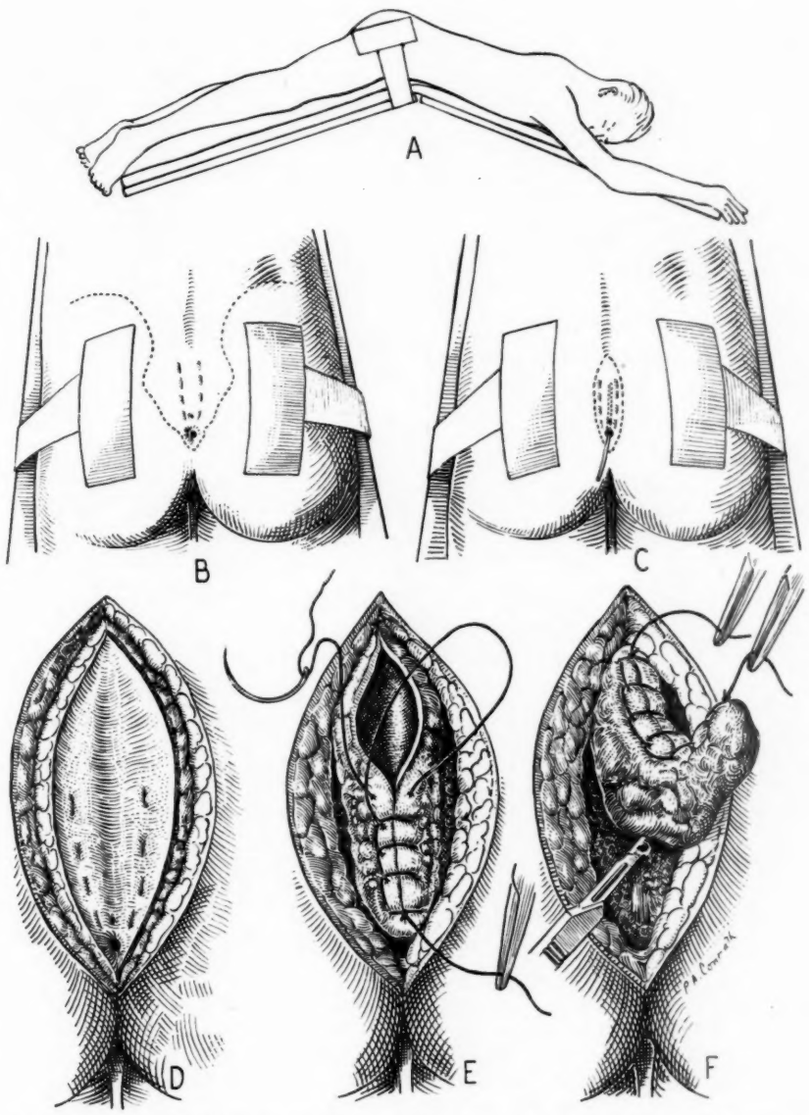

FIG. 1A–F. A, position of patient. B, the buttocks are pulled widely apart with strips of adhesive tape. C, a probe is inserted into the sinus tract to determine its extent. D, an elliptical incision no wider than 2 cm. and extending vertically .5 cm. above and below the tract is made through the full thickness of skin into the subcutaneous tissue. E, to seal the sinus opening, the inside skin margins are tightly sutured together with a locked continuous suture of heavy material. F, the pilonidal tract with as little normal tissue as possible is excised. (See Principles of Dissection, in text.)

spreading contamination. Spinal anesthesia is also to be avoided.

Steps of Operation. To gain good exposure of the sacrococcygeal area the patient is placed prone on the table, partly jackknifed, and the buttocks pulled widely apart with strips of adhesive tape made more adherent by spraying the buttocks with tincture of benzoin. (Fig. 1A and B.) This flattens the operative site and aids accurate estimation of the size of the tissue block to be removed. Moreover, by putting tissues under tension sharp dissection is made easier.

After preliminary soap and water preparation and partial draping, the sinus tract is probed to determine its extent. (Fig. 1C.) Sometimes the opening of the tract is bridged by a recent thin growth of epithelium. If so, this bridge should be perforated so that the probe can be introduced. The upper and lower angles

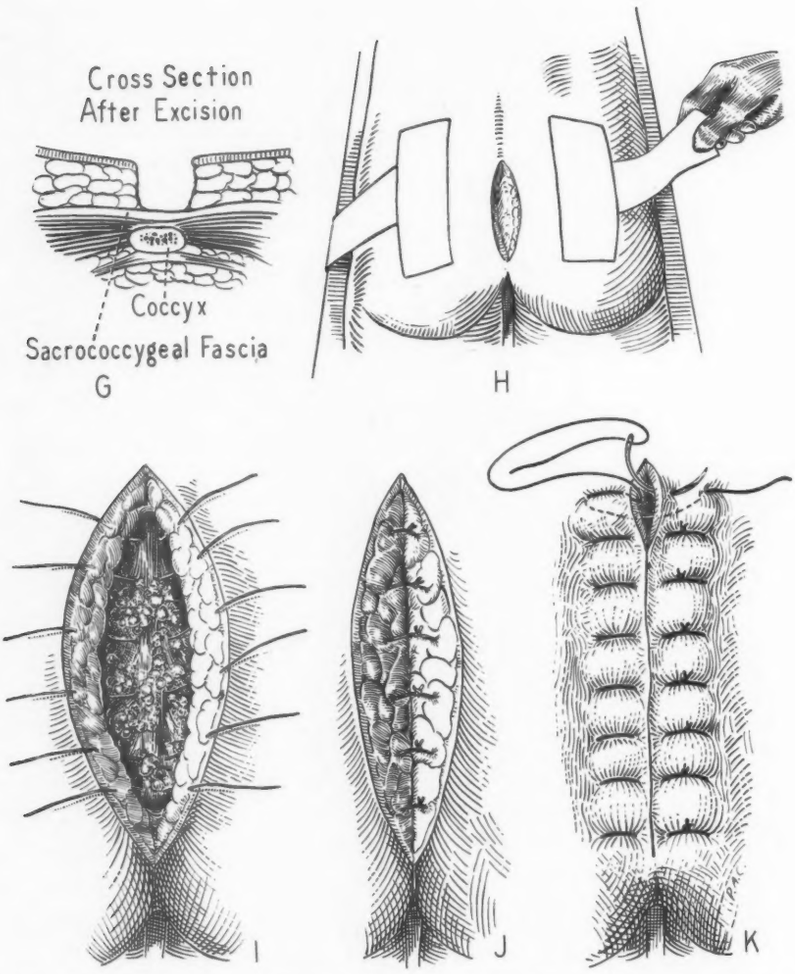

FIG. 1G–K. G, cross section of sacrococcygeal region after excision. H, the adhesive traction is released. I, interrupted No. 00 chromic catgut sutures are placed in the subcutaneous tissue and sacrococcygeal fascia, eliminating dead space. J, appearance of wound after subcutaneous sutures are tied. K, the skin edges are approximated with interrupted vertical mattress sutures of No. 4-0 silk.

of the elliptical incision should extend ½ cm. beyond the vertical length of the tract. The ellipse of skin to be excised should be as narrow as possible, not more than 2 cm. (Fig. 1D); preliminary incision should have reduced the wider diseased tissue to less than this width. The full thickness of skin is incised and the inside skin margins are sutured together over the tract with continuous tightly locked suture of heavy material so as to seal the opening and prevent contamination from this source. (Fig. 1E.) The ends of the sutures can be grasped for traction. If a sinus is not present, this suture is, of course, not required.

The used instruments and drapes are discarded and the area is again prepared with soap and water and fully draped, being sure that the anus is excluded from the operative field.

Principles of Dissection. Dissection through the subcutaneous tissues (Fig. 1F) should be done, bearing in mind the removal of as small an amount of normal tissue as possible. The following points should also be observed:

1. Sharp dissection is desirable, but strands of fibrous tissue and blood vessels across the dissection plane are bluntly isolated by spreading the blades of a mosquito forceps and are divided between clamps.

2. The dissection should stay as close to the diseased tissue as possible, but entering the sinus should be avoided. Often the wall can

be recognized by its bluish cast, somewhat resembling a blue dome cyst of the breast. If the sinus is inadvertently opened, as has happened in several of my operations, the spilled contents can be suctioned off and the dissection should proceed, making sure that none of the wall is left behind.

3. Dissection should when possible be along a plane at right angles with the plane of the skin. It should start at the inferior angle where gravity favors the least obscuration of the wound by blood.

4. All bleeding vessels, no matter how small, should be clamped and tied. For this, curved mosquito forceps and No. 000 chromic catgut are used. Between thirty and fifty ties are usually required in a well executed operation to give complete hemostasis. Considering the fact that only a small block of tissue is removed, the number of ties belies the oft-repeated statement that this area has a poor blood supply.

5. Opening of tissue planes other than those necessary to remove the diseased tissue is to be avoided. It is not always necessary to expose the sacrococcygeal fascia.

6. Scar from previous surgery need be removed only to the extent that it is part of the wall of the diseased tissue.

7. After excision the wound is copiously irrigated with saline.

Figure 1G shows a cross section through the area after excision of the pilonidal tract.

Closure. The adhesive traction is now released, allowing the edges of the wound to come closer together. (Fig. 1H.) Because so little tissue is removed, closure is easily accomplished without tension and without leaving dead space. The subcutaneous tissue is closed with interrupted sutures of No. 00 chromic catgut, the complete row before tying, placed so as to eliminate dead space. (Fig. 1I and J.) The skin is closed with interrupted vertical mattress sutures of No. 4–0 silk, making sure of accurate approximation and eversion of the edges, which ordinarily have a tendency to invert. (Fig. 1K.) Drainage is not used.

Dressing. To further insure hemostasis and elimination of dead space a pressure dressing is applied. A smooth pile of gauze is built up on the wound and a piece of marine sponge is incorporated in it to even the pressure over the wound. The vertical extent of the dressings should be limited to little more than the length of the wound. The dressings are tightly held against the wound by transverse strips of adhesive tape. More pressure is obtained by a snugly applied Y binder in the male and a T binder in the female patient.

Postoperative Management. Penicillin and streptomycin are administered, usually in the combined intramuscular form, for four days. Paregoric is given for three days. A liquid diet is given for three days, then a general diet. Bowel movements are initiated on the fourth postoperative day by the instillation of tap water enemas. After each bowel movement wiping of the anus is directed away from the wound. After the first bowel movement the bulky dressings are replaced by light ones and they are changed if local soilage occurs.

Ambulation is begun on the first postoperative day, but sitting is at first avoided. Recently the patients have been leaving the hospital when I have been satisfied with their bowel hygiene, usually on the fifth postoperative day. Otherwise they stay until the skin sutures are removed on the seventh day. After removal of the skin sutures a simple dressing is worn for a few days for protection against trauma. A full bath is permitted about the tenth day. New hair is kept shaved close to the wound during the observation period.

TABLE 1

RESULTS OF EXCISION AND PRIMARY CLOSURE FOR PILONIDAL DISEASE IN FIFTY CASES FROM 1946 TO 1956, INCLUSIVE

Previous operation	15
One operation	10
Two operations	3
Three operations	2
Patients requiring preliminary incision	20
At office	14
At hospital	6
Average hospital stay	6.9 days
Longest	9 days
Shortest	4 days
Primary healing	50
Complications:	
Patients	8
Number	13
One or more stitch abscess	4
Redness and edema of wound edges	6
Ingrown hair removed later	2
Tender swelling 3 mo. after surgery	1

RESULTS AND COMMENTS

The statistics in Table 1 show that fifty consecutive patients with pilonidal disease have

been treated by excision and primary closure using the technic described heretofore. All healed by primary union with only the minor complications shown in the table. That these have not all been simple cases is attested by the fact that fifteen patients had previous operations; two patients had as many as three operations. Many patients had complicated tracts with multiple openings requiring incision and packing, as previously described.

Because primary healing of the wound seems to avoid "recurrence," the planned follow-up was for six months only. This is admittedly a defect in the study, as recurrences following primary union have been noted by other authors. Whether these recurrences are due to ingrown hairs, as suggested by Patey and Scarff [*2,4*], is not known. The finding of ingrown hair in the scars of two of my patients and a tender swelling in the scar of one patient after primary healing had occurred suggests this possibility; on the basis of these complications I have been advising the patients to shave the hair adjacent to the scar periodically. There may also be merit to the suggestions of Smith [*11*], Patey and Scarff [*4*], Swinton and Wise [*12*] and others to use epilation doses of x-ray to the area as an adjunct to treatment, but I have not had to resort to it. All but one patient, who moved away in three months, were seen six months postoperatively. A few patients were examined during the course of other illnesses as late as nine years after surgery. No recurrences were found or reported.

It is evident from the foregoing description that much time and effort is expended for what seems to be a relatively minor lesion. Nevertheless, this time and effort is probably less than might have been expended if the wounds did not heal by primary union, and I am convinced that without this attention to detail the satisfactory results would not have been obtained. A concentrated prophylactic effort seems necessary to avoid infection in this highly vulnerable area. The results obtained lend strong support to the conclusion of Rogers [*1*] that so-called recurrences are in reality wound infections, since rigid adherence to principles calculated to avoid infection have been followed by good healing after excision and primary closure.

CONCLUSIONS

1. Recurrences of pilonidal disease following surgery are not true recurrences but are infections of the wounds with failure to heal completely.

2. If excision and primary closure are to result successfully, infection must be avoided. To prevent infection, elaborate and meticulous measures are required in the surgical management.

3. A detailed technic of excision and primary closure, including the preoperative, operative and postoperative management, is described. This technic has as its main aims the excision of as little normal tissue as possible and the prevention of contamination in an area where this is difficult to accomplish.

4. Fifty consecutive patients with postanal pilonidal disease have had their diseased tissues excised and their wounds closed primarily. All wounds healed by primary union and there were no known recurrences.

REFERENCES

1. Rogers, H. Pilonidal sinus. *Surg., Gynec. & Obst.*, 57: 803, 1933.
2. Patey, D. H. and Scarff, W. R. Pathology of postanal pilonidal sinus. *Lancet*, 2: 484–486, 1946.
3. Dwight, R. W. Pilonidal sinus: evaluation of plastic closure using flaps of gluteal muscle. *Arch. Surg.*, 64: 438–442, 1952.
4. Patey, D. H. and Scarff, W. R. Pilonidal sinus in a barber's hand with observations on postanal pilonidal sinus. *Lancet*, 2: 13–14, 1948.
5. Gifford, H. The role of hair in the pathogenesis of postanal pilonidal sinus. *Stanford M. Bull.*, 12: 185–189, 1954.
6. Joseph, H. L. and Gifford, H. Barber's interdigital pilonidal sinus; the incidence, pathology and pathogenesis. *Arch. Dermat. & Syph.*, 70: 616–624, 1954.
7. Davage, O. N. The origin of sacrococcygeal pilonidal sinus based on an analysis of 463 cases. *Am. J. Path.*, 30: 1191–1205, 1954.
8. Patey, D. H. and Williams, E. S. Pilonidal sinus of umbilicus. *Lancet*, 2: 281–282, 1956.
9. Phillips, C. W. Pilonidal disease in a military hospital. *J. Nat. M. A.*, 46: 329–332, 1954.
10. Phelan, J. T. Pilonidal sinus. *Mil. Med.*, 119: 172–177, 1956.
11. Smith, R. M. Roentgen irradiation as an adjunct to surgical treatment of pilonidal cyst. *Am. J. Roentgenol.*, 38: 308–311, 1937.
12. Swinton, N. W. and Wise, R. E. The significance of epilation as an adjunct in the treatment of pilonidal sinus disease. *Am. J. Surg.*, 90: 775–779, 1955.

Volvulus of the Cecum

WITH A REVIEW OF THE RECENT LITERATURE AND REPORT OF A CASE OCCURRING AS A POSTOPERATIVE COMPLICATION

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REPORTS of volvulus of the cecum are not rare in the surgical literature. In the last ten years approximately a dozen articles on this subject have appeared in the leading surgical journals. There is a comprehensive bibliography on cecal volvulus prior to that time, extending back to the year 1841 when Rokitansky described the first case. Despite this, however, volvulus of the cecum remains a relatively rare condition and many a busy surgeon has never encountered this lesion in his surgical lifetime. In 1952 Dean [*11*] estimated that somewhere in the neighborhood of 313 cases of cecal volvulus had been reported. In 1956 Powell and Bowers [*19*] stated that more than 400 cases have been described. Undoubtedly there have been other cases which have not found their way into print.

Probably the only valid reason for reporting another case of volvulus of the cecum is to focus further attention on this problem and thus promote an increased awareness of a condition, which prior to the last decade, has been so rarely diagnosed before operation. It is not the purpose of this presentation to attempt a thorough review of this subject or to theorize further on the etiology of cecal volvulus. The reader is referred to the many reviews in the medical literature [*4–7,10,17*]. However, a rather thorough perusal of the literature of the past ten years appears to indicate from the discussion accompanying the reported cases that little progress has been made in diagnosis and results of treatment. As to the former point, most writers have stated that the difficulty in diagnosis should not exist, and would not, save for a lack of awareness of possible torsion of the cecum. As to the latter question, which is one of mortality rate, most reports cite mortality statistics gathered from well known articles, none of which includes any significant number of cases treated within the past ten years. It must be remembered, of course, that no one surgeon or clinic has had a large enough experience with volvulus of the cecum to have statistics of significance.

Volvulus of the cecum is not a leading cause of intestinal obstruction. Percentage incidence has been given as varying from as low as .083 [*17*] to as high as 4.3 [*10*]. However, acute twisting of the cecum is an emergency and one which may carry a high mortality if not treated promptly, especially with the advent of gangrene of the colon. In 1905 Corner and Sargent [*1*] presented a 52.5 per cent mortality rate for collected patients operated upon and 100 per cent mortality for those patients treated without operation. More recently, in 1947, Young et al. [*6*] commented on the "appalling mortality" in treatment of cecal volvulus. In 1949 Donhauser and Atwell [*10*], in a review of 100 cases, found an over-all mortality rate of 42 per cent. In those in whom gangrene of the cecum had occurred, the death rate rose precipitously to 72 per cent. Of the six new cases included in this study of Donhauser and Atwell, three patients had advanced gangrene of the cecum at the time of exploration and failed to recover. The foregoing statistics, which are widely quoted, certainly fail to show a significant lowering of the mortality rate.

Sixty-two cases of volvulus of the cecum, all proved at operation, have been collected from leading journals for a period extending over the last ten years [*6–20*]. In this series there were but eight deaths, for a mortality rate of only 12.9 per cent. Of these eight deaths, five patients [*6,9,10*] were found to have advanced gangrene of the cecum, two others [*17*] were

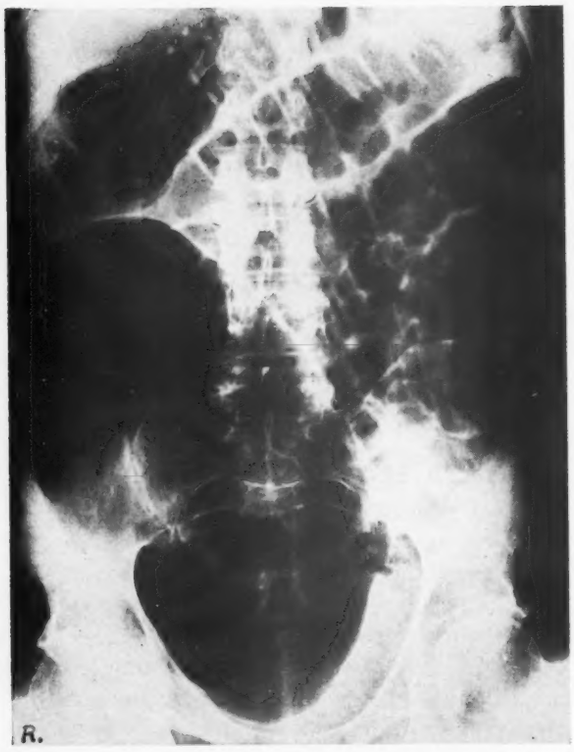

FIG. 1. Roentgenogram showing tremendously dilated cecum in the right lower quadrant of the abdomen, accompanied with marked dilatation of the small bowel.

elderly and autopsy showed bronchopneumonia in both, and one patient died on the fifty-first postoperative day of heart disease after having made a complete gastrointestinal recovery [*12*]. Although 13 per cent is not a negligible death rate, it is hardly comparable to a mortality rate of 50 per cent, so often cited in the past.

Increased diagnostic acumen and knowledge of proper corrective surgical measures can hardly claim all the credit for improved results in the treatment of volvulus of the cecum. Much of the credit must go to our improved methods of suction decompression, broad-spectrum antibiotics and better knowledge of the use of blood, fluid and electrolyte replacement therapy.

Many authors have commented on the possible causal relationship of previous abdominal operations, even remote ones, to the development of intestinal volvuli. Dixon and Meyer [*8*] found that eleven of twelve patients with cecal volvulus had undergone previous operations; ten of these were intra-abdominal procedures. Volvulus of the cecum occurring as a postoperative complication has also received attention and study in the literature. Nelson [*3*], writing in 1928, said, ". . . but volvulus occurring post-operatively must be exceedingly rare because a careful review of the literature recently by Pratt and Fallis and to a less extent by myself has failed to reveal a single case report." Nelson then proceeded to report a case of cecal volvulus with onset four days following uterine suspension and right salpingo-oophorectomy. Jordan and Beahrs [*16*] have reported six cases of volvulus of the cecum occurring in the immediate postoperative period. The following report illustrates another such case.

CASE REPORT

A fifty-eight year old white man (O. L. W., No. 84041) was admitted to Kennedy Hospital on April 23, 1953, with a recurrent inguinal hernia of about four years' duration. Left inguinal herniorrhaphy, performed in 1948, constituted the only surgical procedure this man had undergone. Past history revealed only that the patient had received treatment three years previously for "a positive blood test." On physical examination positive findings were limited to the following: blood pressure 160/80, harsh diastolic and soft systolic heart murmurs and associated Corrigan pulse; there was an enlarged left external inguinal ring with a moderately large, easily reducible hernial sac descending into the scrotum. Laboratory work was unremarkable with the exception of positive serologic tests for syphilis.

Left inguinal herniorrhaphy was carried out under spinal anesthesia on April 29th. The course was uneventful until the third postoperative day when marked distention of the lower abdomen developed, accompanied with discomfort but little actual pain. The patient was treated with several enemas and eliminated small amounts of gas. The distention became more marked, however, and a large tympanitic mass the size and shape of a football was very prominent, lying diagonally in the right lower abdominal quadrant. A colon tube was inserted in the rectum but did not help reduce distention. Flat x-ray films of the abdomen were taken and revealed a hugely dilated colonic loop occupying the right lower abdomen and pelvis. Considerable gas was visible in the remainder of the colon and also in the small bowel. (Fig. 1.) A diagnosis of volvulus of the sigmoid colon was thought to be most likely. However, sigmoidoscopy to a distance of 25 cm. failed to visualize a site of twisting in the colon. The patient's temperature was 99.4°F. (oral); the white blood cell count was 12,000 per cu. mm., with 88 per cent segmented neutrophils and 12 per cent lymphocytes. There was still little complaint of abdominal pain and no vomiting had occurred. A Levin tube had been placed in the stomach and Wangensteen suction instituted. About ten hours after onset exploratory laparotomy was undertaken under general endo-

tracheal anesthesia. The peritoneum was opened through a lower midline incision. A tremendously dilated cecum, measuring 17 cm. in diameter, was encountered. There appeared to be a constriction in the region of the mid-ascending colon; the transverse colon was moderately dilated but the descending colon was normal in size. Due to the large size of the cecum and the presence of many dilated loops of small intestine obscuring the field it was not possible to visualize readily the actual site of twisting in the colon. However, on the assumption that a volvulus was present, the cecum was gently rotated 180 degrees in a counterclockwise direction. Immediately there was a rush of gas into the transverse colon and the size of the cecum diminished. It was then easily apparent that the cecum and ascending colon had a long mesentery, were very mobile and were readily displaced from their usual anatomical position. Considerable atony of the cecum remained but the color was good and no splitting of the serosal covering had occurred. A large mushroom catheter was inserted as a cecostomy tube and brought out through a right lower quadrant stab wound. There was considerable evacuation of gas and liquid fecal material. The midline wound was closed in layers and reinforced with retention sutures.

Postoperatively the patient had a very persistent ileus despite continuous suction decompression, enemas, prostigmine and careful attention to electrolyte balance. The ileus gradually subsided after being intermittently troublesome for a period of ten days. Bowel movements per rectum were reestablished, the cecostomy tube was removed and the fistula healed promptly. Superficial separation of the midline wound developed; this was subjected to secondary closure and healed well. The patient was discharged home in good condition on June 15, 1953. In December, 1953, follow-up studies revealed the patient to be asymptomatic except for moderately resistant constipation. Barium enema showed diverticulosis of the colon and an enlarged, pendulous cecum.

Comment. Almost without exception, those who have written on cecal volvulus have commented on the chronic, recurrent nature of this disorder. As early as 1905 Corner and Sargent [*1*] noted that patients with volvulus of the cecum are likely to give a history of habitual constipation, occasional attacks of pain on the right side, nausea, and often, rapid pulse and elevation of temperature. Such an attack, it is stated, is relieved by the passage of flatus and liquid feces. The patient cited in this report is no exception. Further questioning of the patient after recovery from the operation revealed that he had suffered for many years with resistant constipation requiring frequent laxatives for relief. He had also noted occasional "bloating," sometimes relieved by bouts of diarrhea and the passage of considerable gas.

This case of volvulus of the cecum occurred abruptly on the third day following a relatively simple repair of a recurrent inguinal hernia on the left side. What was the possible predisposing factor here? Manipulation of the intestines and withdrawal of abdominal packs have been suggested as causes for the development of volvulus. A review of the operative note for the herniorrhaphy reveals no handling of the bowel and no insertion of abdominal packs. It is interesting to note that two of Jordan and Beahrs' cases of cecal volvulus occurring in the immediate postoperative period followed operations in which the peritoneal cavity was not entered. In one case the primary surgical procedure was bilateral simple mastectomy, and in the second case volvulus followed the final stage of a bilateral supra- and infradiaphragmatic sympathectomy for hypertension. The inciting cause of volvulus may be anything which disturbs an already mobile cecum, one which has a long mesentery and is therefore not well secured in the right lower abdominal quadrant. Also implicated in the literature have been: pregnancy, labor, violent peristalsis, intra-abdominal tumors, cysts, fecaliths, foreign bodies, congenital bands and strictures, inflammatory conditions of the colon and habitual constipation. Special emphasis has been placed on obstructing lesions of the left colon as predisposing to cecal volvulus [*17*].

Young et al. [*6*] have written, "Although the diagnosis of acute volvulus of the cecum is not usually made pre-operatively, it is believed that by careful x-ray study and a thorough review of the history and physical findings, it can be arrived at more frequently." Other authors have commented on the fact that exact preoperative diagnosis is rarely made [*7,11,17*]. In the literature on cecal volvulus of the past decade, thirty-two case reports were studied in which a preoperative diagnosis has been specifically mentioned [*6–19*]. It is rewarding to note that in twenty-four of these a diagnosis of "volvulus" had been made prior to operation. Furthermore, in fifteen of these thirty-two reports, the site of the volvulus was correctly placed preoperatively in the cecum. This is apparently no longer a situation, then, in which the diagnosis is rarely made.

Most authors are agreed that x-ray is very helpful in the diagnosis of torsion of the cecum.

Simple flat and upright films of the abdomen have been found to be sufficient in most cases, although many writers have stressed the positive value of retrograde barium study of the colon when the diagnosis is in doubt. McGraw et al. [7] express the opinion that the criteria for diagnosis are present in the simple x-ray film of the abdomen and they believe that the barium enema should be reserved for the obscure cases. The six x-ray diagnostic criteria outlined by McGraw are recommended to the reader.

It has often been stated in the literature that the flat roentgenogram in cecal volvulus shows the cecum in an abnormal position. It has also been claimed that 90 per cent of these ectopic cecums lie in the left upper quadrant [6,11]. Abnormal position of the dilated cecum is undoubtedly a common finding and a valuable diagnostic point. As to the great majority (90 per cent) being found in the left upper quadrant, a review of cases from the last decade does not substantiate this claim. Thirty-five cases were found in which the flat film x-ray findings were described [6–19]. In these a dilated cecum was noted in the left upper quadrant in only thirteen reports (37 per cent). It is noteworthy that a large, dilated loop of bowel, identified before or after operation as the cecum, has been found in all the abdominal quadrants.

Once the diagnosis of volvulus of the cecum is reasonably certain in a patient with acute intestinal obstruction, treatment must not be delayed. Treatment is surgical and is well standardized. In the non-gangrenous cases, derotation with cecostomy and/or cecopexy will suffice to relieve obstruction and distention and fix the cecum in the right lower quadrant, thus preventing further twisting. In the doubtful or frankly gangrenous cases, resection of the right colon with primary ileo–transverse colon anastomosis, a Mikulicz type of resection or even exteriorization of the involved bowel are the procedures demanded, the choice depending on the findings and the condition of the patient. The former procedure is probably the most formidable but is the one of choice, if circumstances permit, since it materially shortens the hospital stay.

SUMMARY

A case of volvulus of the cecum is presented in which simple detorsion and cecostomy resulted in a favorable outcome. The problem of cecal volvulus is discussed briefly and several important diagnostic criteria are emphasized. A short review of the recent literature is presented and reveals that increasing experience with this condition has resulted in improved diagnostic accuracy and a considerably lower mortality rate.

REFERENCES

1. Corner, E. M. and Sargent, P. W. G. Volvulus of the caecum. *Ann. Surg.*, 41: 63–75, 1905.
2. Pratt, J. D. and Fallis, L. S. Volvulus of cecum and ascending colon. *J. A. M. A.*, 89: 1225, 1927.
3. Nelson, H. M. Postoperative volvulus of cecum. *Am. J. Surg.*, 5: 398–400, 1928.
4. McGowan, J. M. and Dixon, C. F. Volvulus of the cecum—report of case. *Proc. Staff Meet., Mayo Clin.*, 11: 337–341, 1936.
5. Wolfer, J. A., Beaton, L. E. and Anson, B. J. Volvulus of the cecum: anatomical factors in its etiology and report of a case. *Surg., Gynec. & Obst.*, 74: 882–894, 1942.
6. Young, E. L., Morrison, H. R. and Wilson, W. E. Volvulus of the cecum and ascending colon. *New England J. Med.*, 237: 78–86, 1947.
7. McGraw, J. P., Kremen, A. J. and Rigler, L. G. The roentgen diagnosis of volvulus of the cecum. *Surgery*, 24: 793–804, 1948.
8. Dixon, C. F. and Meyer, A. C. Volvulus of the cecum. *S. Clin. North America*, 28: 953–963, 1948.
9. Melchior, E. Volvulus of the cecum—an appeal for primary resection with report of 6 cases. *Surgery*, 25: 251–256, 1949.
10. Donhauser, J. L. and Atwell, S. Volvulus of the cecum—a review of 100 cases in the literature and a report of 6 new cases. *Arch. Surg.*, 58: 129–148, 1949.
11. Dean, D. L. Volvulus of the cecum: with report of 2 cases. *Ann. Surg.*, 136: 319–325, 1952.
12. Byrne, J. J., Swift, C. C. and Farrell, G. E., Jr. Volvulus of the cecum. *Arch. Surg.*, 64: 378–383, 1952.
13. Ryan, A. J. and Burbank, J. Volvulus of the cecum. *Am. J. Roentgenol.*, 68: 399–402, 1952.
14. Glass, B. A. and Abramson, P. D. Volvulus of cecum due to lithopedion. *Am. J. Surg.*, 86: 348–352, 1953.
15. Desforges, G. and Wilson, H. Volvulus of the cecum. *Am. J. Surg.*, 86: 116–119, 1953.
16. Jordan, G. L. and Beahrs, O. H. Volvulus of the cecum as a postoperative complication. *Ann. Surg.*, 137: 245–249, 1953.
17. Wilson, H. E., Desforges, G., Dunphy, H. G. and Campbell, A. J. A. Volvulus of the cecum—emphasis on possible predisposing lesions of the left colon. *Arch. Surg.*, 68: 593–604, 1954.
18. Young, M. O. Coexistent volvulus of the splenic flexure and cecum. *Surgery*, 37: 983–990, 1955.
19. Powell, J. H. and Bowers, R. F. Volvulus of the cecum. *Ann. Surg.*, 143: 126–129, 1956.
20. Nelson, T. G. and Bowers, W. F. Volvulus of the cecum and sigmoid colon. *Arch. Surg.*, 72: 469–478, 1956.

The Use of Systemic Tetracyclines and Ultraviolet in Cancer Detection

A PRELIMINARY REPORT

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FLUORESCENCE of tumor tissue under ultraviolet light was first noted by Rall et al. at the National Cancer Institute and first reported in 1957 [1]. This was discovered by accident when autopsy specimens of metastatic cancer of the breast were subjected to ultraviolet light. The tumor tissue showed a yellowish fluorescence while the remaining normal tissue was only autofluorescent, i.e., demonstrating a bluish direct reflection of light from the surface of the tissue. The medications of the patient were reviewed and the tetracyclines were suspected because of their yellow color in solution.

This initial discovery provoked further experimental study. Mice with six day old implants of sarcoma 37, were given tetracyclines intraperitoneally for five days in doses of 50 mg. per kg. The mice were then autopsied at varying intervals, after administration of the drug was stopped. After six hours, fluorescence was seen in all tissues except the brain, and after twenty-four hours only bone and tumor retained this fluorescence up to twenty days later.

METHOD AND MATERIALS

My experience is limited to the specimens from controls and tetracycline prepared patients, subjected to ultraviolet light immediately after surgery.

The ultraviolet light source is a 9 watt, 3660 Angstrom unit, mineralight placed 6 inches from the tissues.

At this distance the tetracycline treated cancer gave a yellow-orange fluorescence throughout the whole lesion and sharply demarcated its borders from the autofluorescent normal tissue.

Terramycin®* was the source of the tertacycline. A review of the literature [2–6] reveals that an oral dose of 500 mg. of terramycin every six hours will give a blood level of 3 μg./ml.; in comparison, an intravenous dosage of 500 mg. every twelve hours supplies a blood level of 12 μg./ml. The intravenous tetracycline was placed in 100 cc. of 5 per cent glucose solution and given by slow drip in approximately 50 per cent of the cases, to supplement the oral dosage. Calculations were then made of the blood level of tetracycline in each patient comparing the dosage administrated and the method with the previously stated levels derived from the literature.

In all cases the drug was discontinued at least twelve hours before surgery to enable the body to flush the tetracycline out of the normal tissue but retain it in the cancer.

EXPERIMENTAL DATA

Over 1,000 specimens of normal tissue showed only autofluorescence.

Forty-two cases of carcinoma specimens without tetracycline treatment showed only autofluorescence.

An additional control group was composed of eleven patients with suspected tumor preoperatively, with a blood level of 5 μg./ml. or higher for four days before surgery, showing only autofluorescence.

* Terramycin, brand of oxytetracycline, supplied by Chas. Pfizer & Co., Inc., Brooklyn, New York.

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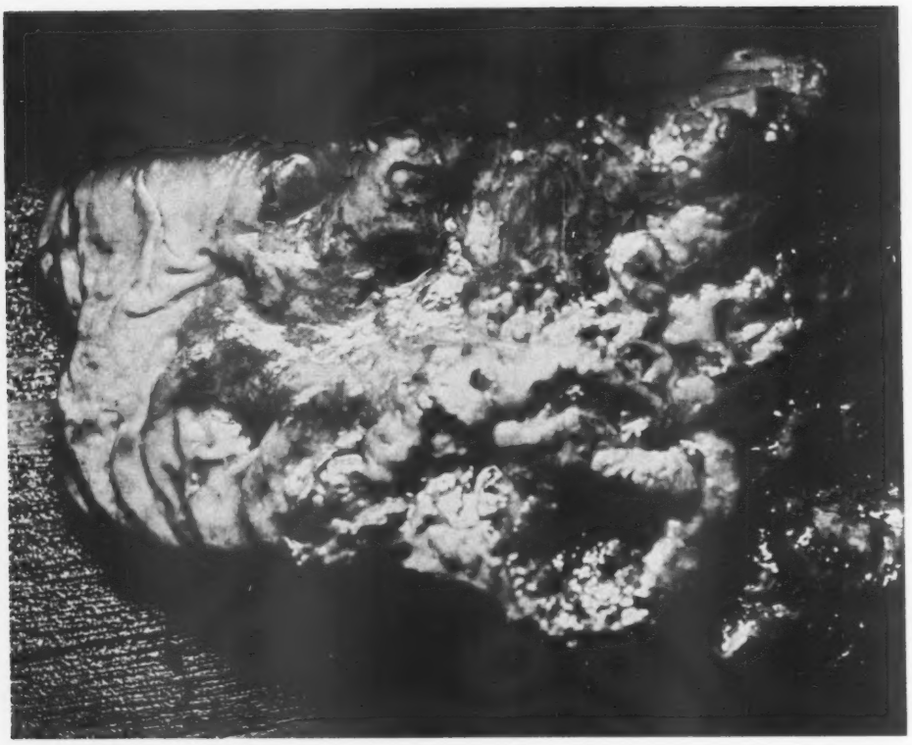

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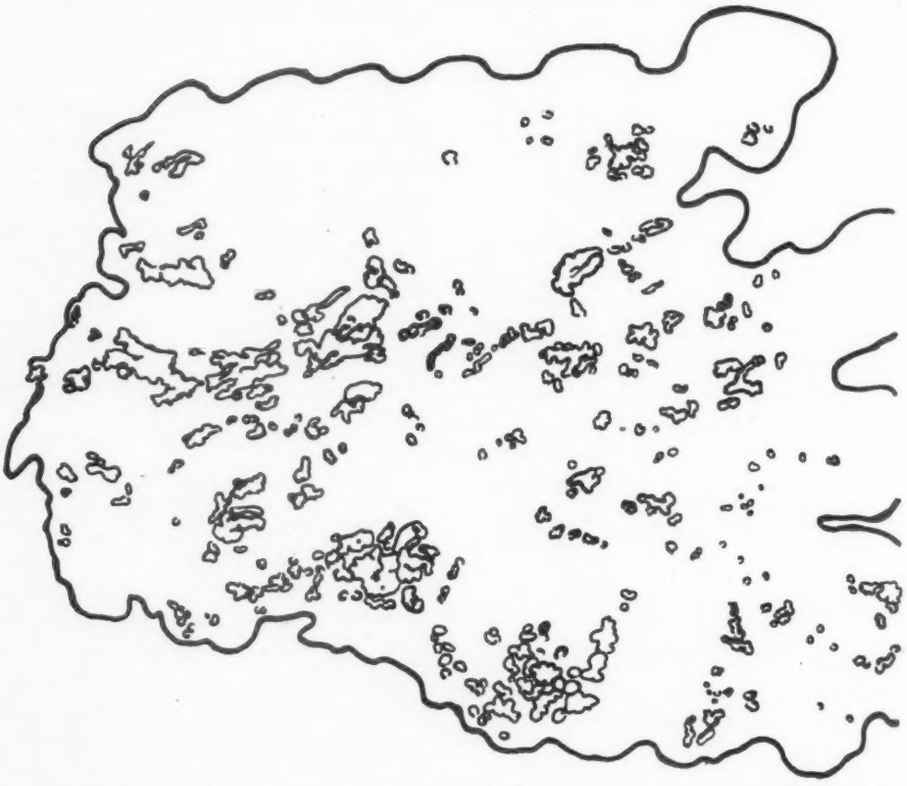

FIG. 1. Case IV. A, picture taken under ultraviolet light. Adenocarcinoma of rectal sigmoid, which appears a diffuse yellow, with some areas offering greater fluorescence. The snow indicates the areas of greater fluorescence. B, artist's diagram on transparent paper of the tumor shown in (A), with the circumscribed area corresponding to the snow.

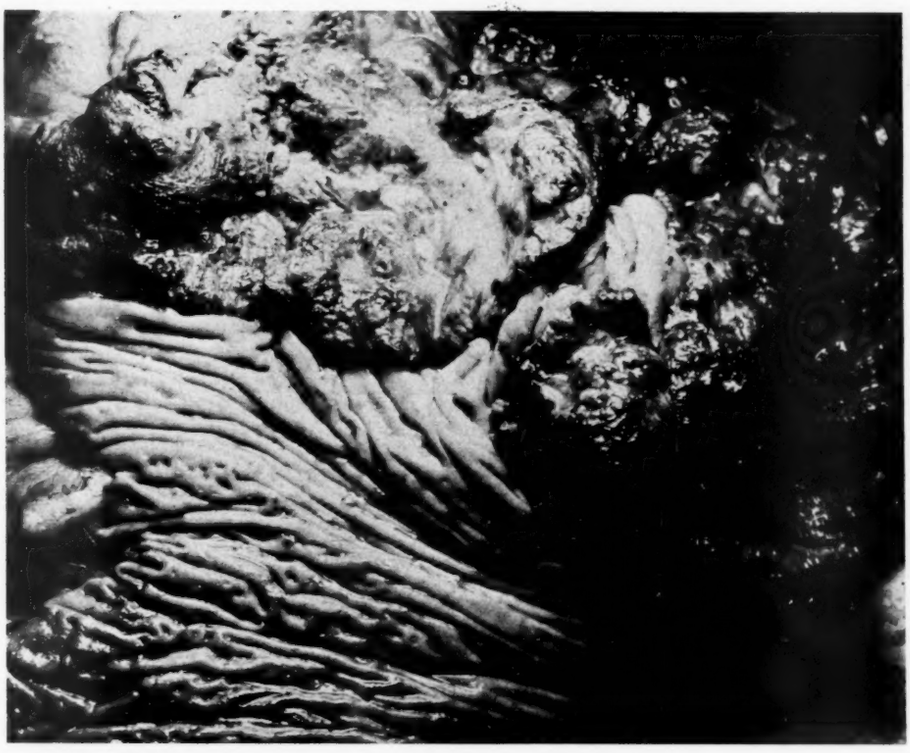

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FIG. 2. Case x. A, picture taken under ultraviolet light. Adenocarcinoma of cecum, which appears a diffuse yellow, with some areas of greater fluorescence. The snow indicates the areas of greater fluorescence. B, artist's diagram on transparent paper of the tumor shown in (A), with the circumscribed areas corresponding to the snow.

TABLE 1
FLUORESCENCE

Case No. and Initials	Age, Race and Sex	Diagnosis	Fluorescent Areas	Fluorescent Intensity	Lymph Nodes	
					Fluorescent Intensity	Microscopically
I, F. C.	82, W, M	Adenocarcinoma of descending colon	Multiple areas 1 cm. in diameter	Fair	Questionable	Positive
II, M. P.	36, W, F	Congenital polyps with constrictive adenocarcinoma of sigmoid	Multiple areas 2 cm. in diameter at major constrictive site and also at two sessile polyps; remaining polyps autofluorescent and benign	Good	Questionable	Positive
III, A. P.	84, W, F	Adenocarcinoma of rectal sigmoid	Multiple areas 1 cm. in diameter	Good	Questionable	Positive
IV, G. O.	72, W, M	Adenocarcinoma of rectal sigmoid	Multiple areas 1 cm. in diameter (Fig. 1.)	Good	Questionable	Positive
V, G. B.	77, W, M	Inoperable adenocarcinoma of rectum	Entire biopsy specimen showed fluorescence	Good	.....	.....
VI, C. B.	27, N, F	Osteogenic sarcoma of right femur	Entire tumor in the bone marrow, bone substance, periosteal surface, and direct intramuscular extension showed diffuse fluorescence	Excellent	None	Negative
VII, A. K.	73, W, M	Adenocarcinoma of sigmoid	Multiple areas 5 mm. in diameter	Poor	None	Negative
VIII, W. I.	36, W, F	Intraductal carcinoma of breast	Multiple areas 5 mm. in diameter present in excisional biopsy	Good	None	Negative
IX, G. C.	76, W, M	Adenocarcinoma of sigmoid	Multiple areas 2 cm. in diameter	Good	None	Negative
X, W. C.	72, W, M	Adenocarcinoma of cecum	Multiple areas 2 cm. in diameter (Fig. 2.)	Good	None	Negative
XI, E. P.	63, W, F	Adenocarcinoma of rectum	Entire rectal biopsy specimen	Excellent	.....	.....

This group included: (1) Adenoma of thyroid, two cases; (2) bronchiectasis, one case; (3) diverticuli, one case; (4) fibrocystic disease of breast, two cases; (5) benign gastric ulcers, two cases; (6) rectal polyp, one case; and (7) ulcerative skin lesions, two cases.

Eleven patients with cancer were prepared with tetracycline. The blood level in these patients was 5 to 10 μg./ml. for four days or more before surgery. My visual impression of the fluorescence is noted as: none, questionable, poor, fair, good, or excellent. (Table 1, Figs. 1 and 2.)

COMMENTS

Helander and Bottiger [7], by the technic of a fluorescent microscope, found terramycin concentrated in the reticuloendothelial system (bone marrow, spleen and lymph nodes) and in the liver and kidney. They demonstrated none in connective tissue, cartilage, bone, walls of vessels, brain, muscle, peripheral nerves or lungs.

Milch et al. [8] suggest that tetracycline forms a complex with new bone matrix and calcium.

Hobby and associates [9] state that the mode of action of tetracycline on bacteria, may be of the following: (1) Interference with protein metabolism; (2) interference with phosphorylation; (3) interference with oxidation of glutamate; and (4) interference with oxygen consumption and general respiration. Is it possible that one of these actions is instrumental in differentiating cancer from normal tissue by fluorescence?

Although the number of cases is limited, there have been no false positives. Tetracycline-treated pathologic conditions, other than cancer, give no fluorescence. The degree of fluorescent intensity has not always been the best but it has been present. Increased blood levels of tetracycline seem to give a better fluorescence. Also the more anaplastic the tumor the better the fluorescence. Necrotic tissue shows no fluorescence which is perhaps explained by the absence of blood supply. Cancer tissue has the ability to bind tetracycline, possibly through an enzyme factor in metabolism; glutamate has been suspected. Cancer tissue without tetracycline preparation shows only autofluorescence, as does normal tissue. Formalinization of tumor tissue destroys fluorescence.

Radioactive tagged tetracycline studies are currently being performed, and may offer a diagnostic or therapeutic medication of the future.

CONCLUSIONS

1. A preliminary report on the fluorescence of cancer in tetracycline prepared patients is presented.

2. This field needs additional investigation into the biochemistry of the attraction of cancer tissue for the tetracyclines.

3. Further refinement of the tetracyclines and further alterations in the source of ultraviolet light may provide a method of detecting metastatic tumor deposits at the surgical table.

Acknowledgment: I would like to thank the staff of the Creighton Memorial St. Joseph's Hospital, Omaha, Nebraska for their cooperation.

REFERENCES

1. RALL, D., LOO, T. and LANE, M. Appearance and persistence of fluorescence material in tumor tissue after tetracycline administration. *J. Nat. Cancer Inst.*, 19: 79–85, 1957.
2. WERNER, C. A. et al. Absorption and excretion of terramycin in humans: comparison with aureomycin and chloramphenicol. *Proc. Soc. Biol. & Med.*, 74: 261–267, 1950.
3. HUNT, A. D., JR., KELLY, R. S., CORIELL, L. J., MURPHY, L. M., TASHMAN, S. G. and STEVENS, C. Studies in absorption and distribution of terramycin in children. *J. Pediatrics*, 40: 252, 1950.
4. FINLAND, M., PURCELL, E. M., WRIGHT, S. S., LOVE, B. D., JR., MOU, T. R. and KASS, E. H. Clinical and laboratory observations of a new antibiotic tetracycline. *J. A. M. A.*, 154: 561–568, 1954.
5. O'REGAN, C. and SCHWARZER, S. Intramuscular terramycin: laboratory and clinical studies in children. *J. Pediat.*, 44: 172–180, 1954.
6. MUSSELMAN, M. M. and DAVID, H. L. Antimicrobial activity, pharmacology, chemistry and clinical uses of oxytetracycline. *Internat. Rec. Med. & General Practice Clin.*, 168: 112–131, 1955.
7. HELANDER, S. and BOTTIGER, L. E. On distribution of terramycin in different tissues. *Acta med. Scandinav.*, 147: 71, 1953.
8. MILCH, R., RALL, D. and TOBIE, J. E. Bone localization of tetracyclines. *J. Nat. Cancer Inst.*, 19: 87–93, 1957.
9. HOBBY, G. L., LENERT, T. F., PICHULA, D., KISELUK, M. and HUDDERS, E. The antimicrobial action of terramycin. *Ann. New York Acad. Sc.*, 53: 266, 1950.

Paraesophageal Ciliated Cysts of the Mediastinum

REPORT OF FOUR CASES AND REVIEW OF THE ENGLISH LITERATURE

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PARAESOPHAGEAL ciliated cysts of the mediastinum comprise an increasingly encountered group of congenital abnormalities. In 1940, Heuer and Andrus [1] were able to collect only twenty-five cases of this entity, to which they added one case of their own. Creech and DeBakey [2] in 1954 were able to collect forty-nine cases from the literature including those reported by Heuer and Andrus, to which they added two cases of their own. A further review of the English literature since Creech and DeBakey's article reveals two more cases. The first was reported by Minor [3] who treated the cyst by marsupialization to the esophagus with an excellent recovery. The second case was reported by Desforges, Madison, and Starkey [4], and the diagnosis of paraesophageal cyst was established as the cause of a bloody pleural effusion. The cyst was a large 20 cm. lesion attached to the lower esophagus and held 700 cc. of typical contents of this type of cyst. Recovery followed operative removal. It is the purpose of this paper to report four more cases of this congenital abnormality and to discuss the present concepts of this interesting clinical entity.

EMBRYOLOGY

Some authors, notably Maier [5], believe that bronchogenic cysts and paraesophageal cysts are one and the same and we agree with this theory. The trachea and esophagus arise from a common anlage, and this fact along with the histological similarity of the two types of cysts would certainly support this theory. Whether they should be labelled as bronchogenic or paraesophageal would appear to depend on their location at operation or postmortem examination rather than on their histological appearance which can be identical. Another factor which supports this theory is that at the time when the trachea and esophagus separate (4 to 5 mm. stage of the embryo), they are both lined with ciliated columnar epithelium. If at this stage tissue fragments are sequestrated this would account for the common components of these cysts. Moreover, the elongation of the esophagus which occurs as the heart descends accounts for the frequent location of paraesophageal cysts in the lower third of the esophagus.

HISTOLOGY

Bronchogenic cysts are commonly located at or just below the bifurcation of the trachea deep within the mediastinum. They may occur in chains or may be single and multiloculated. These cysts usually do not communicate with any other organ, are thin walled and of various sizes and contain either a clear, gelatinous or thick milky material. Microscopically, the cysts are lined by pseudostratified ciliated columnar epithelium and in some cases islands of stratified squamous epithelium are present. The wall of the cyst is made up of fibrous connective tissue and may contain cartilage, smooth muscle, mucous glands and nerve trunks. The stratified squamous epithelium is indicative of a later budding process after the lining epithelium of the esophageal anlage has begun its transition from pseudostratified ciliated columnar to stratified squamous epithelium. For a comprehensive review of the

FIG. 1. Case I. This film demonstrates the well rounded lesion in the cardiophrenic angle. On the lateral projection this lesion was in a posterior position.

FIG. 2. Case I. The photomicrograph shows a section of the wall of the cyst which is lined by a pseudostratified columnar epithelium composed of interlacing bundles of dense fibrous connective tissue and smooth muscle. (Note cystic structure with cuboidal epithelium lining.)

histology of this lesion, the reader is referred to Anderson [*6*], Schlumberger [*7*], and Ackerman [*8*].

In our experience any cysts of this type below the carinal region have been closely associated with the esophagus, and we have called them paraesophageal ciliated epithelial cysts. These do not communicate with the esophagus except in those rare instances when previous infection has created a fistulous tract into the esophagus. They are located within the muscularis of the esophagus necessitating the splitting of the muscle layers to effect their removal. In three of the four cases reported in this article, the cysts were easily shelled out and the muscularis closed to eliminate the defect. In Case IV the cyst could not be shelled out due to previous infection and had to be removed piecemeal. Despite the infection it did not communicate with the esophagus. These paraesophageal cysts contain the same type of material and have the same histological appearance as bronchogenic cysts. For these reasons, we propose that these cysts be called bronchoesophageal cysts rather than bronchogenic or paraesophageal cysts.

Enterogenous or gastroenterogenous cysts (often called duplication cysts) are an entirely different entity. These contain all the elements normally found in the walls of the gastrointestinal tract. They are thought to be either buds pinched off from the developing foregut or failure of coalescence of the vacuoles formed during the development of the foregut. The reader is referred to excellent reviews of this subject by Lindquist and Wulff [*9*], Olenik and Tandatnick [*10*], and Boyd [*11*].

SYMPTOMATOLOGY

Bronchoesophageal cysts are often asymptomatic and are usually found accidentally on a routine chest plate or at postmortem examination. Such a cyst in childhood, if located in the carinal region, may produce severe respiratory distress [*2*]. Cysts in close proximity to the esophagus may produce symptoms such as dysphagia, a sensation of substernal fullness and even cardiac manifestations. Creech and DeBakey [*2*] emphasized the occurrences of cardiac irregularities in association with this condition and the disappearance of these symptoms following the removal of the lesion. Other writers have reported the association of other types of mediastinal lesions with cardiac irregularities [*12,14,15*]. In the four cases reported herein, two patients had symptoms referable to the esophagus and one of these two had some cardiac irregularity which she referred to as "palpitations." This patient obtained complete relief of both complaints following surgery. The

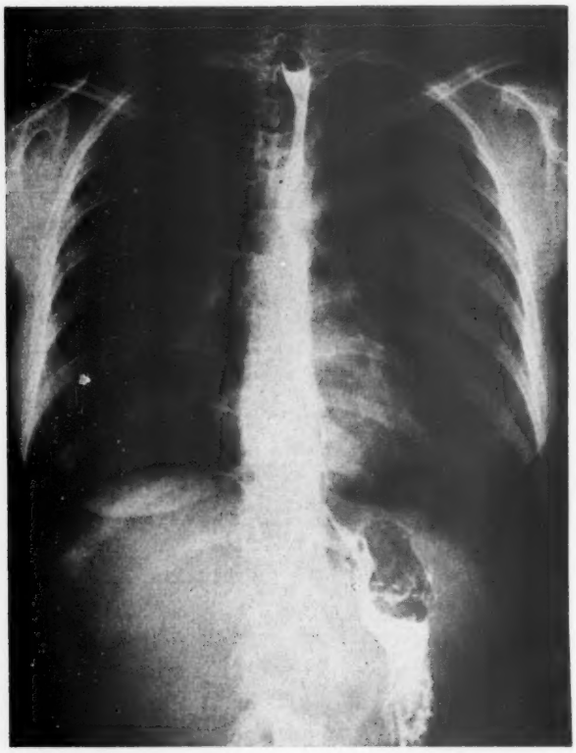

FIG. 3. Case II. Posteroanterior esophagram demonstrating a lesion lying just above the diaphragm and extending into both sides of the thorax in an extrapleural position.

other patient with dysphagia alone also had complete relief of the symptoms.

CASE REPORTS

CASE I. A thirty-five year old white man was admitted to the hospital in 1955 with a mass in the left side of the pleural cavity which had first been noted in 1944. The only studies done prior to this time were skin tests which were positive for coccidioidomycosis and histoplasmosis. Studies during this hospital admission revealed a mass in the left side of the chest in the posterior mediastinum overlying the body of T11. (Fig. 1.) Barium swallow test revealed a normal mucosal pattern of the esophagus. At surgery a ciliated paraesophageal cyst was found and removed with no difficulty. (Fig. 2.) The patient had a postoperative hemothorax of undetermined origin which cleared up on conservative therapy. He was returned to duty having a clear chest film and no symptoms.

CASE II. A thirty-eight year old white woman was admitted to the hospital in 1954 for study relative to a mediastinal mass. She had had some trouble swallowing for the preceding four years, manifested by a sensation of food sticking just before entering the stomach. She had no symptoms

FIG. 4. Case III. Posteroanterior esophagram demonstrating the lesion on the right with indentation of the esophagus.

referable to her cardiovascular system. X-ray studies as early as 1951 revealed a partially calcified posterior mediastinal mass. (Fig. 3.) Thoracotomy was recommended and accepted by the patient. At surgery, an intimately adherent partially calcified mass was removed from the retrocardiac region of the esophagus. It stripped with some difficulty but there was no connection with the esophagus at any place. Her postoperative course was uneventful.

CASE III. A forty-eight year old white woman was admitted to the hospital in 1956 for study of possible Raynaud's disease. No definite evidence of this disease was found but during the course of her hospital work-up, a mass was noted in the posterior mediastinum. (Fig. 4.) On the basis of barium swallow test, a diagnosis of a paraesophageal mass was made and thoracotomy recommended. At surgery a ciliated paraesophageal cyst (Fig. 5) was found and removed with no difficulty. Her postoperative course was benign except for mild pain in the right arm and shoulder secondary to a trigger point in the upper aspect of the scar. This responded nicely to physiotherapy and local procaine blocks.

CASE IV. A thirty-five year old white woman was transferred to the hospital in 1957 with a diagnosis of either a leiomyoma of the esophagus or a paraesophageal ciliated cyst. The diagnosis had been established by a barium swallow test (Fig. 6) which had been made because the patient had some vague symptoms of dysphagia and "palpitations." The cardiac symptoms were some substernal pain and

FIG. 5. Case III. The photomicrograph shows the wall of the cyst lined by pseudostratified columnar epithelium which demonstrated considerable degeneration. The wall is composed of interlacing bundles of smooth muscle and dense fibrous connective tissue and contains a large cartilaginous plate.

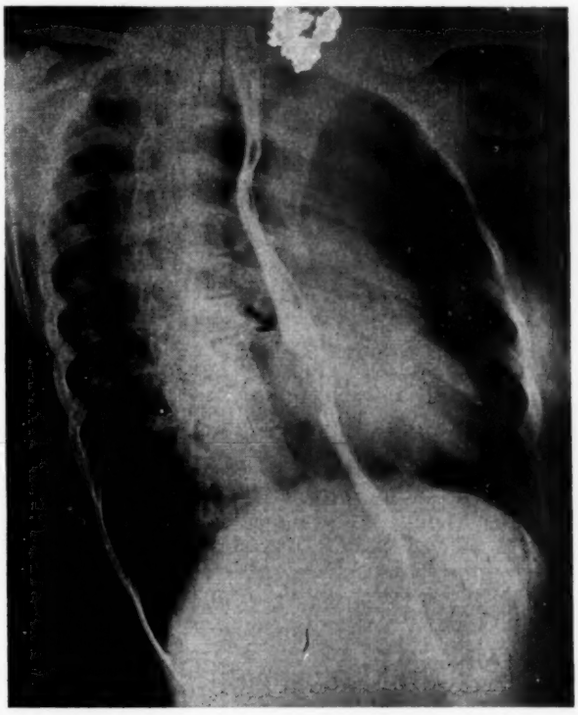

FIG. 6. Case IV. Left anterior oblique esophagram demonstrating the lesion lying behind the heart and the esophagus.

palpitation which were more noticeable at the time of eating. Thoracotomy was performed and a paraesophageal cyst removed with some difficulty due to a previous infection in the cyst. Despite the infection there was no communication with the esophagus. Her postoperative course was very benign and all her symptoms of dysphagia and palpitation disappeared following surgery.

COMMENTS

Bronchoesophageal cysts are an interesting clinical entity which are being diagnosed and treated more frequently than ever before. They are most frequently diagnosed as an incidental finding on a chest film since many of them are asymptomatic. If symptomatic, the usual symptoms are dysphagia, usually mild in degree, and in a few cases, cardiac irregularities have been described as a result of the presence of these cysts in close proximity to the heart. As shown in Figures 3 and 6, the retrocardiac position certainly could account for this symptomatology. On barium swallow test these lesions can be demonstrated and show that the esophageal mucosal pattern is intact, indicating an origin other than from the mucosa of the esophagus.

It is our belief that all of these lesions should be removed surgically for it is difficult if not impossible to differentiate them from others occurring in the mediastinum which may be malignant. The accepted method of treatment is complete surgical removal of the cyst. In many cases these can be shelled out easily, but if infection has previously been present they may have to be removed piecemeal. In patients who demonstrate cardiac irregularities symptoms have either disappeared or markedly improved after removal of the cyst and the dysphagia has been relieved.

SUMMARY

1. Four cases of paraesophageal epithelial cysts are presented.

2. This makes a total of fifty-five cases of this clinical entity in the literature.

3. It is our belief that these lesions and those called bronchogenic cysts are one and the same entity, being different only in their location and having the same histological pattern and embryological origin. We believe that these two

types of cysts should be referred to as bronchoesophageal cysts.

4. Treatment is surgical removal and should be recommended to rule out a possible malignancy.

REFERENCES

1. Heuer, G. J. and Andrus, W. The surgery of mediastinal tumors. *Am. J. Surg.*, 50: 162, 1940.
2. Creech, O., Jr. and DeBakey, M. Ciliated epithelial cysts of the esophagus associated with cardiac abnormalities. *J. Thoracic Surg.*, 28: 64–77, 1954.
3. Minor, G. R. Mediastinal cyst treated by marsupialization to the esophagus. *Ann. Surg.*, 139: 230–235, 1954.
4. Desforges, G., Madison, W. and Starkey, G. Bloody pleural effusion caused by a bronchogenic cyst. *J. Thoracic Surg.*, 30: 698–701, 1955.
5. Maier, H. Bronchogenic cysts of the mediastinum. *Ann. Surg.*, 127: 476–502, 1948.
6. Anderson, W. A. D. Textbook of Pathology, 3rd ed. St. Louis, 1957. C. V. Mosby Co.
7. Schlumberger, H. Atlas of tumor pathology (tumors of the mediastinum), Sect. v, Fascicle 18, 1951. Armed Forces Institute of Pathology.
8. Ackerman, L. V. Textbook of Surgical Pathology St. Louis, 1953. C. V. Mosby Co.
9. Lindquist, N. and Wulff, H. Mediastinal enterocystoma: report of case in 7-month-old child with impending suffocation, operation and recovery. *J. Thoracic Surg.*, 16: 468–476, 1947.
10. Olenik, J. and Tandatnick, J. Congenital mediastinal cysts of foregut origin. *Am. J. Dis. Child.*, 71: 466–476, 1946.
11. Boyd, D. Lesions of the superior mediastinum: diagnosis and treatment. *S. Clin. North America*, 33: 834–837, 1953.
12. Adamson, W. The influence of mediastinal tumors on the production of cardiac arrhythmias. *Texas State J. Med.*, 28: 361–363, 1932.
13. Sauerbruch, F. and Fick, W. Operative beseitigung einer kongenitalen cyste der speiserohre. *Zentralbl. f. Chir.*, 58: 2938–2941, 1931.
14. Donavan, M. A. Pain of unusual duration due to progressive coronary occlusion with associated mediastinal tumor. *Am. Heart J.*, 32: 786–793, 1946.
15. Rawls, W. and Amcona, V. An unusual case of paroxysmal auricular fibrillation due to mediastinal malignant lymphoma. *Am. Heart J.*, 41: 311–315, 1951.

A Modified Needle Holder

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SURGEONS who use a needle holder without inserting the thumb and finger into the rings of its handle are aware of the motions saved. The use of a "clip on" spring (manufactured by the H. C. Wallace Co., Wayne, Michigan) facilitates this maneuver because it maintains the needle holder open with its jaws separated 5 mm. (Fig. 1.) The open needle holder can then be held with the hand relaxed, thus facilitating the grasping of needles. Needles are grasped by squeezing the handles of the needle holder together without inserting the thumb and finger into the rings of its handle. The needle holder is opened by exerting lateral pressure on each handle in opposite directions. (Fig. 2.) The "clip on" spring then separates and maintains the jaws of the needle holder open to a sufficient degree to allow easy grasp of the needle. This spring is readily removed for cleaning purposes.

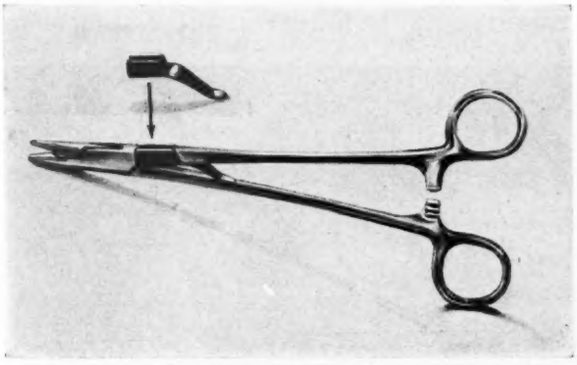

FIG. 1. Needle holder with "clip on" spring in place.

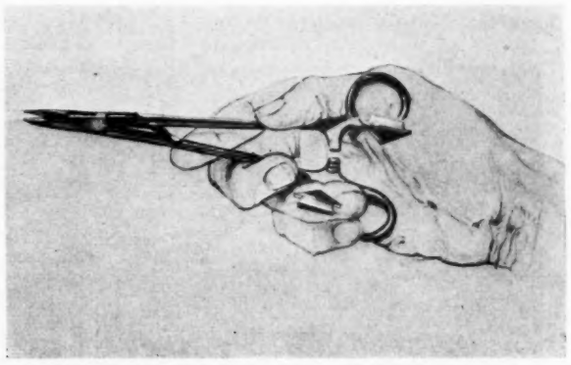

FIG. 2. Method of opening needle holder without inserting thumb or finger into rings of handle.

A Helpful Cassette Holder for Operative Cholangiography

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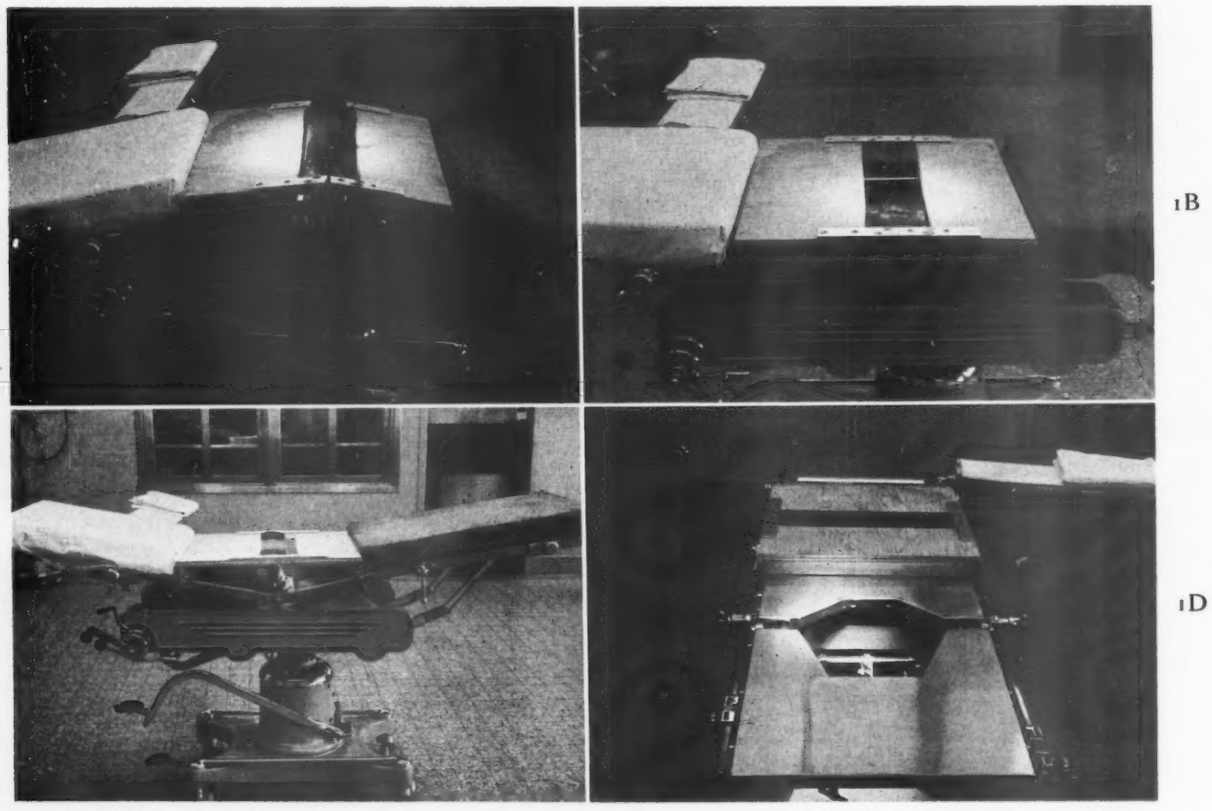
ALTHOUGH there is some controversy regarding false negative and false positive readings in the course of operative cholangiography, most surgeons are convinced that it is a useful aid at the operating table. In many instances, however, one may be inclined to omit the procedure because it interferes with the orderly performance of the operation. In our experience several of the obstacles to performance of operative cholangiography are as follows: (1) The placing of cassettes without holders is a strain on the attendants lifting the patient; it leads to breaks in sterile technic and is time consuming. (2) One-piece cassette holders do not permit the full use of the table, that is, flexion, extension and use of the gallbladder rest. (3) The cassette holder is frequently out of position.

For the last two years the East Orange Veterans Administration Hospital has used a cassette holder which will permit rapid changing of cassettes and also full use of the operating table.



1A 1B 1C 1D

FIG. 1. A, table extended; gallbladder bar elevated. B, table straight; cassette in place. C, table flexed; gallbladder bar elevated. D, table straight; an end view.

(Fig. 1A to D.) In addition, the holder is so constructed that it is automatically positioned.

The cassette holder consists of a pair of wooden frames separated by hinged metal bars. The bars are placed on the table so that the hinges correspond to the breaking point of the operating table. There is sufficient space between the wooden frames to permit passage of the gallbladder rest. The frame is mounted on metal legs which fit snugly over the tracks at the sides of the table.

Our procedure is to place the cassette holder on the table so that the gallbladder bar may be raised. The patient is then placed on the table. At this time, and before anesthesia is started, a scout film is taken to determine the radiographic technic necessary. The patient, having been spared anesthesia during this period, is now anesthetized and the operation begun. The gallbladder bar can extend the body and elevate the liver. The table can be changed to suit the needs of the operator but it must be straightened out before a cassette can be slipped into the cassette holder. It is believed that continued efforts at simplifying this procedure will encourage its more frequent usage.

"John Jones was born [in] Jamaica, Long Island, in 1729. . . . After a preliminary education in private schools in New York, he decided to become a physician and became apprenticed to a relative, Dr. Cadwalader of Philadelphia. After three years in Philadelphia he went to Europe and studied under John Hunter and Percival Pott. A year later Jones studied under Petit and Le Dran in Paris. Petit was the inventor of the screw tourniquet and of improvements in the technique of amputations. . . . Jones also did anatomical work with the elder Monro at Edinburgh. He got his degree in medicine from the University of Rheims, and returned to New York to practice. He was the first to do the operation of lithotomy in New York. . . . He was one of the first in this country to limit his work to surgery. In addition, being an accomplished obstetrician, he continued his interest in this branch. Jones became surgeon to the American troops during the French and Indian War, earned great fame, so much so that when Baron Dieskau was wounded and captured at Lake George, he pleaded to be put under Dr. Jones' care. When King's College (now Columbia University) was organized in 1768 Dr. Jones was appointed professor of surgery. He also lectured on obstetrics. In 1775, he published 'Plain Remarks Upon Wounds and Fractures.' It was reprinted in 1776. This was the first American book on surgery. . . . When the British army took possession of New York, Dr. Jones left the city. For a while he had a seat in the State Senate, then he entered the medical department of the army. Ill health compelled him to return to civil duty. He went to Philadelphia, found relief from the asthma there, and became a permanent resident in 1779. The next year he succeeded Dr. John Redman as one of the physicians of the Pennsylvania Hospital. He was the first president of the humane society, a consulting physician of the Philadelphia Dispensary, and, in 1786, was elected the first vice-president of the College of Physicians of Philadelphia, which office he occupied until his death. Dr. Jones was a friend and physician to Benjamin Franklin and attended him in his last illness. In 1790 he went to New York to consult in the case of George Washington, and was later his family physician in Philadelphia. Dr. Jones died in 1791." (T. S. W., *Am. J. Surg.*, 16: 123, 1932.)

An Enterotomy-Colotomy Decompressor for the Treatment of Intestinal Obstruction

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SINCE intestinal obstruction is a frequent surgical finding, it is desirable and a necessary part of the surgical armamentarium to have available a relatively non-traumatic instrument that will successfully decompress distended, obstructed loops of bowel. It is exceedingly difficult to thread segments of intestines on the available suction decompressors used in intestinal obstruction. The surface suction area on the conventional suction tip rarely exceeds 4 inches; thus the degree and rapidity of absorption is governed not only by these factors but also by the size of the perforation in the suction tip. The size of the perforation and the amount of suction surface is directly proportional to the evacuation of intestinal contents and ultimate decompression of the involved portions of small or large intestines.

In order to treat conditions incident to intestinal obstruction with greater facility and success, it was decided that intestinal aspiration with a larger suction tip was necessary.

After considerable experimentation, the suction apparatus finally devised consists of a large

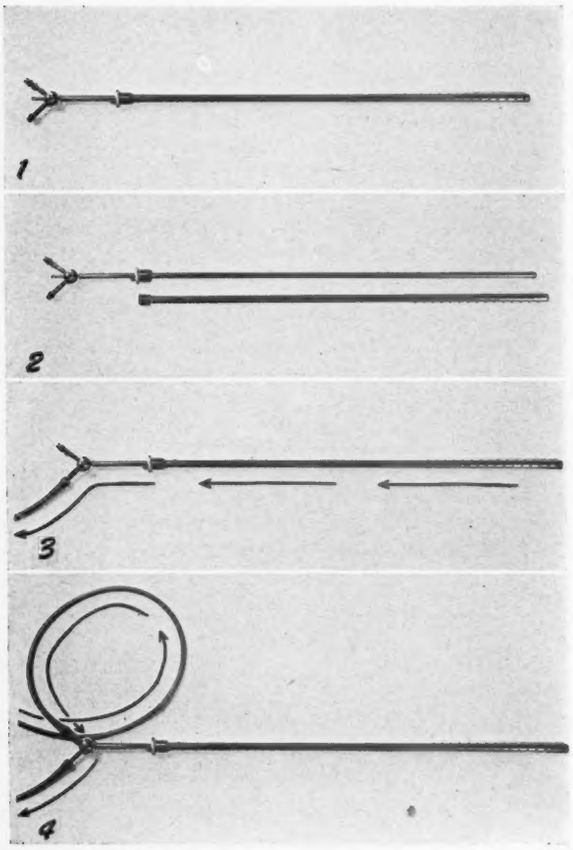

FIG. 1. The outer and inner tubes of the decompressor are engaged. The handle of the stopcock is in the neutral position.

FIG. 2. Outer tube and inner tube of decompressor. By turning the outer tube in a counterclockwise direction the outer tube is disengaged from the inner tube.

FIG. 3. Decompression of the distal segment of intestine. Aspiration and evacuation of contents from the distal segment of the intestine can be achieved by turning the handle of the stopcock clockwise and parallel to the shaft of the inner tube which receives the rubber tubing leading from the wall suction. An arrow indicates the site of attachment of the rubber suction tubing and the direction of suction from the distal segment of intestine.

FIG. 4. Decompression of the proximal segment of intestine. Aspiration and evacuation of contents from the proximal segments of the intestine can be done by turning the handle of the stopcock counterclockwise and parallel to the sidearm projecting from the inner tube. The arrow indicates the site of attachment to various tubes that may be passed up the proximal end of the intestine through the enterotomy site. Arrows indicate the direction of suction for decompressing the proximal segment of intestine.

3/8 inch outer tube made of Monel metal which contains a small 1/4 inch tube of Monel. The distal 6 inch section of the outer tube is perforated with numerous 3/32 inch holes spaced 3/8 inch apart. (Fig. 1.) There is a large 1/8 inch hole in the center of the distal tip. The inner tube also has multiple holes in the wall as well as a distal opening. Four holes approximately 1/2 inch from the threaded portion of the outer tube are placed there to offer some means of control over the amount of suction utilized.

The length of the tube portion is 19 3/4 inches, and is permanently attached to a special two-way stopcock so that the proximal loops of the intestine may be aspirated or irrigated. (Fig. 2.)*

COMMENT

The surgical decompressor may be sterilized by the same methods as other metal surgical instruments. Its advantages over the conventional suction tips are:

1. There is a larger surface suction area with increased diameter of individual perforations which enhances the rapidity of evacuation of intestinal contents and allows a more complete decompression.

2. The operator may thread larger segments of the bowel with less injury to the intestinal walls. Such trauma frequently occurs when great lengths of bowel are forced on a small tube.

3. A longer inner suction tip affords the surgeon a dry field at greater depths in wounds of the abdomen, pelvis or chest.

4. There is a two-way stopcock which not only gives the operator a means of decompressing the distal intestinal lumen but also provides a side arm to which the proximal end of various tubes for intestinal intubation may be attached in decompressing the proximal segments of bowel. This may be used for injecting antibiotics, etc., or to aspirate intestinal contents for diagnostic and clinical studies. (Figs. 3 and 4.)

* Instrument may be obtained from G. P. Pilling & Company, Philadelphia, Pa.

SUMMARY

A new surgical suction instrument has been developed that will facilitate enterotomy or colotomy decompressions incident to intestinal obstruction.

The inner suction tip has clinical application in the abdomen, chest or pelvis in maintaining a relatively bloodless field and affording exposure in the depths of wounds.

CASE REPORTS

Gastric Carcinoma Occurring in a Gastrostomy

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IT is rare that the physician has the opportunity to witness the development of gastric carcinoma in a patient whose stomach has been observed over a period of years. The report concerns a patient, Tom, with a permanent gastrostomy, who has been a subject of study for the past sixteen years and who is the modern counterpart of William Beaumont's famous patient, Alexis St. Martin [1].

CASE REPORT

The patient (No. 250-329) was a seventy-four year old white man who was admitted to University Hospital on September 19, 1956 with a complaint of bleeding from his gastrostomy for one month. Shortly after the onset of the bleeding a tumor mass developed which increased rapidly in size. It was of interest that the tumor developed in an area of the gastrostomy which had been the site of bleeding and ulceration many times during the previous years. The patient had fed himself through his gastrostomy for sixty-five years. When he was nine years old he had accidentally swallowed very hot clam chowder. A complete esophageal stricture developed which necessitated the gastrostomy. During the course of the operation he stopped breathing for a time and the procedure had to be completed rapidly with the result that the stoma was large and presented directly on to the abdominal wall. A binder was required to retain food and gastric contents. Later the stomach was forcefully everted by a fall on a football and the gastrostomy was enlarged surgically to permit reduction. This chain of unfortunate events resulted in a gastrostomy which had a large collar of gastric mucosa on the surface of the abdomen. (Fig. 1.) Past history and review of systems were not considered relevant to the present illness.

It is pertinent, however, to describe the feeding regimen of this patient that permitted an adequate nutritional status over a period of sixty years. Food prepared by his devoted wife is chewed and expectorated into a funnel in the wide open gastrostomy. Certain liquids are poured into the funnel. When the cardiac and antral portions of the stomach are filled, a tight abdominal binder is applied and the patient remains for a period of time in a semirecumbent position.

Physical examination revealed a small slender man weighing 102 pounds. He was mentally alert and did not appear ill. Blood pressure was 110/70 mm. Hg. On the superior lateral aspect of the gastrostomy there was a well demarcated lobular tumor mass 4.0 cm. in diameter. (Fig. 2.) It was firm and did not involve the skin surrounding the gastrostomy. The remainder of the physical examination was unremarkable.

Laboratory data revealed the following: Hemoglobin, 9.4 gm. per cent; hematocrit, 32 per cent; white blood cells, 7,500 per cu. mm.; neutrophils, 62 per cent; lymphocytes, 37 per cent; monocytes, 1 per cent; bleeding time, eight seconds; clotting time, five minutes, forty-five seconds; blood urea nitrogen, 10 mg. per cent; total serum protein, 5.4 gm. per cent with an albumin/globulin ratio of 1.7/1.0; CO_2 combining power, 32.6 mEq./L., potassium, 3.69 mEq./L., sodium, 160 mEq./L., and chloride, 112.2 mEq./L. On September 22, 1956, 250 μc. of sodium phosphate were given intravenously in an anticubital vein. Counts were then taken over the tumor mass and the surrounding normal gastric mucosa at fifteen-minute intervals for two hours, and a final count at twenty-four hours. (Table 1.)

On September 19, 1956, an incisional biopsy

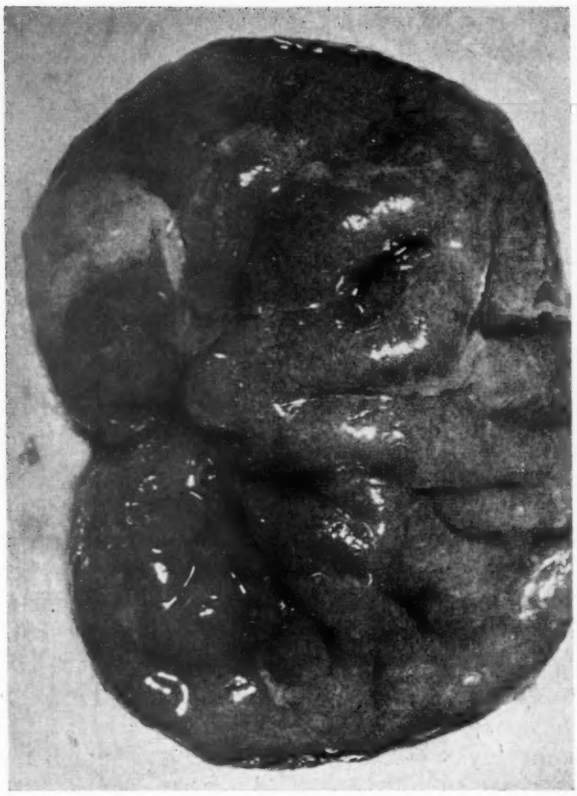

FIG. 1. Appearance of gastrostomy several months before the development of the neoplasm. The grey area at 7 o'clock is the apparent site of the carcinoma.

FIG. 2. Gross appearance of carcinoma five weeks after it was first observed by the patient.

was performed which was interpreted by the pathologist as adenocarcinoma of the stomach. (Fig. 3.) On September 24, 1956, a wide local excision of the tumor was performed under local xylocaine anesthesia.

At this time it was noted that the large gastrostomy comprised most of the body of the stomach with a fairly large proximal fundic pouch and a smaller distal antral pouch. Following mobilization of the gastrostomy and body of the stomach, the local excision was carried out with a 3 to 4 cm. margin of normal mucosa and gastric wall on all sides.

The patient tolerated the surgery very well and was able to feed himself in the usual manner on the second postoperative day. He was discharged on the third postoperative day and at the time of this report (November, 1957) has no evidence of local recurrence.

EARLIER STUDIES ON TOM

Studies on Tom were begun in 1941 and led to numerous published reports [*2–11*]. It was possible to correlate blood flow through the mucosa with secretory and motor function and to document the stomach's responses to numerous pharmacodynamic agents including local irritants. It was found that by virtue of the thick investing layer of mucus, the delicate columnar cells of the gastric mucosa were far better protected against chemical irritation than was the skin of the forearm. Striking changes in gastric function were observed in response to meaningful events in the life situation. It was possible to delineate two patterns

TABLE 1
RADIOACTIVITY AFTER INJECTION OF SODIUM PHOSPHATE*

Time (hr.)	Counts per minute	
	Cancer	Normal Mucosa
¼	8,000	8,200
½	7,800	8,700
¾	7,200	7,200
1	6,000	8,000
1¼	8,600	7,600
1¾	11,000	6,500
2	11,000	7,500
24	4,000	8,000

* Radioactivity as measured by a thin-faced Geiger-Mueller tube after intravenous injection of 250 μc. of sodium phosphate.

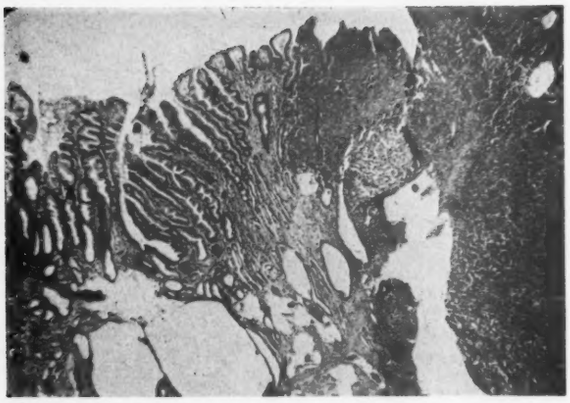

FIG. 3. Microscopic appearance of carcinoma showing transition from wound to neoplastic cells.

of reaction to stress, one with generalized hypofunction of the stomach in terms of vascularity secretion and motor activity and the other characterized by hyperfunction of these indicators. Hypofunction was seen when Tom was dejected or overwhelmed and hyperfunction when he was angry, resentful, and meeting situations in a relatively aggressive fashion.

Often during the course of the studies, small erosions and bleeding points were observed here and there on the exposed collar of mucous membrane. These gave no symptoms and healed within a matter of hours. Such lesions occurred much more readily when the mucous membrane was hyperemic engorged and hyperfunctioning. Under such circumstances even relatively minor trauma resulted in small breaks in the mucosa. One such lesion was exposed to the action of Tom's own gastric juice for a period of four days. A small typical punched-out ulcer with a granulating base resulted. It was covered with a petrolatum dressing and within three days had healed completely leaving no trace even under examination with a dissecting microscope. It may be of significance that the carcinoma occurred in the exposed collar of mucous membrane which was so often exposed to trauma of various sorts including the gauze binder which held Tom's food in his stomach. The carcinoma developed on the opposite side of the exposed collar from the experimental ulcer, however.

COMMENTS

The etiology of the carcinoma in this patient's gastrostomy as well as carcinoma of the stomach in general, is not known. The findings in the case presented herein might be interpreted as implicating in some way local irritative factors. The procedure chosen for treatment was simply wide excision of the tumor under local anesthesia. It was believed that this patient could not tolerate a subtotal or total gastrectomy which under other circumstances would have been preferred. Tom only reluctantly agreed to the surgery which was performed and would not consider a procedure which robbed him of his gastrostomy and his long accustomed way of feeding himself.

Efforts have been made in the past to detect carcinoma of the esophagus and stomach by radioactive phosphorus uptake studies [2]. Tom presented an excellent opportunity for such a study under direct visualization. The results, however, were rather disappointing because the uptake over the carcinoma was elevated for only a very brief period. This may be explained in part by the rather solid avascular nature of the neoplasm or the fact that the radioactive phosphorus was administered intravenously. Apparently, phosphorus exchange in gastric carcinoma is very rapid as it is in some inflammatory lesions. The carcinoma in this case enlarged so rapidly in one month that it suggested an infectious granuloma. At twenty-four hours the uptake over the carcinoma was less than half that of the normal mucosa. This experience does not encourage attempts to localize or detect primary and recurrent carcinoma blindly by means of a counter and tube passed through the esophagus into the stomach.

SUMMARY

A case of a patient who has served the public and the medical profession well in our efforts to understand gastric physiology has been presented briefly because of the development of carcinoma in his gastrostomy. He was treated by conservative local excision because of his age, physical condition and personality make-up. An excellent opportunity was afforded to study radioactive phosphorus uptake in a gastric carcinoma under direct visualization. The findings did not suggest that the method is particularly useful for the detection of carcinoma in intact human stomachs.

ADDENDUM

At the time of this writing (fourteen months postoperatively) there has been no clinical evidence of local recurrence. Because the shape

of the gastrostomy has changed slightly, the patient has had some difficulty with feeding.

REFERENCES

1. Beaumont, W. Experiments and Observations on the Gastric Juice and the Physiology of Digestion. Plattsburg, 1833. F. P. Allen.
2. Nakayama, K. Diagnostic significance of radioactive isotopes in early cancer of the alimentary tract, especially the esophagus and the cardia. *Surgery*, 39: 736, 1956.
3. Wolf, S. Studies on nausea: effects of ipecac and other emetics on the human stomach and duodenum. *Gastroenterology*, 12: 212, 1949.
4. Wolf, S. The relation of gastric function to nausea in man. *J. Clin. Investigation*, 22: 877, 1943.
5. Wolf, S. and Wolff, H. G. Actions of drugs and various chemical agents on the gastric mucosa and gastric function in man. *New York State J. Med.*, 46: 2509, 1946.
6. Wolf, S. and Wolff, H. G. An experimental study of changes in gastric function in response to varying life experiences. *Rev. Gastroenterol.*, 14: 419, 1947.
7. Wolf, S. and Wolff, H. G. Correlation of vascular changes in motor activity and secretion in the stomach of man. *Am. J. Physiol.*, 138: 309, 1943.
8. Wolf, S. and Wolff, H. G. Evidence on the genesis of peptic ulcer in man. *J. A. M. A.*, 120: 670, 1942.
9. Wolf, S. and Wolff, H. G. Human Gastric Function. New York, 1943. Oxford University Press.
10. Wolf, S. and Wolff, H. G. Studies on mucus in the human stomach: estimation of its protective action against corrosive chemicals applied to the gastric mucosa and attempts at quantitation of gastric mucin by two chemical methods. *Gastroenterology*, 10: 251, 1948.
11. Wolf, S. and Wolff, H. G. The gastric mucosa, "gastritis," and ulcer. *Am. J. Digest Dis.*, 10: 23, 1943.

"Samuel Bard, son of the physician John B. Bard who was the first one to report a case of extra-uterine pregnancy in America, was born in Philadelphia, April 1, 1742. When he was four years of age the family moved to New York. When fourteen years old, Samuel entered King's College. In the fall of 1760 he sailed for Europe but was captured by a French privateer and taken to Bayonne where he was confined in the castle. Once he was released he proceeded to London. Recommended by Dr. Fothergill, he was appointed to St. Thomas' Hospital as assistant to Dr. Alexander Russell. Next he went to Edinburgh, graduating in 1765, with great honors. Dr. Bard returned to New York and began practice with his father. . . . Samuel had written his father from abroad that New York should have a medical college. After three years in New York he gained the cooperation of several physicians and in 1768 the school was opened and united to King's College. Bard became professor of the theory and practice of physic. He was twenty-eight years old, the youngest man on the faculty. Bard was loyal to the Crown and when hostilities began in 1776 he moved to Shrewsbury, N. J. When the British captured and occupied New York Bard returned. He built a large and lucrative practice and soon became rich. Perhaps he remembered Fothergill's words: 'I crept over the backs of the poor into the pockets of the rich.' After Washington was inaugurated and made New York his headquarters, Bard became his family physician. Doctor Bard became Dean of the Faculty. He was largely instrumental in the establishment of 'The Society of the Hospital of the City of New York in America,' in the establishment of the city library, and of the New York Dispensary. He retired from practice in 1798. In 1811 he was elected an associate fellow of the College of Physicians of Philadelphia. In 1816 the degree of Doctor of Laws was conferred upon him by Princeton College. In 1771 he published 'An Inquiry into the Nature, Cause and Cure of Throat Distemper, as it is called by the Inhabitants of this City and Colony.' . . . [He] wrote for midwives and young practitioners, 'A Compendium of the Theory and Practice of Midwifery.' . . . In 1811 he published 'A Guide to Young Shepherds,' which for years was considered one of the best authorities on sheep breeding. Several fugitive essays by Bard are preserved in the *American Medical and Philosophical Register*, and *The Transactions of the College of Physicians of Philadelphia* contain several of his papers on yellow fever. In 1819 he wrote 'A Discourse on Medical Education.' Samuel Bard died at Hyde Park, N. Y., on May 25, 1821, in his ninetieth year." (T. S. W., *Am. J. Surg.*, 16: 336, 1932.)

Delayed Spontaneous Rupture of the Extensor Pollicis Longus Tendon Following Blunt Trauma

LeRoy H. Stahlgren, M.D. and Robert J. Rubin, M.D., *Philadelphia, Pennsylvania*

The subcutaneous rupture of one or more tendons at the wrist is an uncommon entity. More commonly separation occurs at the periosteal insertion of the tendons or at their musculotendinous origins [*1*].

Spontaneous rupture of the extensor pollicis longus tendon was initially described in the late nineteenth century by German army physicians [*9*]. Their reports of so-called "drummer's palsy," found among inexperienced army drummers, was initially attributed to a focal neurological deficit. This was ultimately found to be caused by a spontaneous rupture of the extensor pollicis longus tendon which had been involved in a chronic tenosynovitis believed to be secondary to the prolonged trauma of long-standing mechanical irritation.

The older American literature has also described spontaneous rupture of this tendon in tailors, carpenters and basket weavers [*29*]. Such ruptures are so rare that this entity is really not an occupational disease.

Since a normal tendon generally will not rupture through its substance, the factors which facilitate such a separation are outlined [*6,16*].

SPONTANEOUS RUPTURE OF TENDON

I. Post-traumatic
   A. Repeated minor injury, i.e., delayed rupture associated with fractures at the wrist; chronic traumatic tenosynovitis (drummer's palsy)
   B. A single injury which impairs the strength of a tendon with resultant rupture at a later date
II. Diseases of tendon
   A. Tuberculosis
   B. Rheumatoid arthritis
   C. Syphilis, gonorrhea, typhoid
III. Senility
   A. Often coupled with one of the aforementioned factors

McMaster, in a detailed study on the rabbit tendon [*13*], demonstrated that delayed rupture of a tendon occurs after trauma if the tendon is ligated both above and below the site of injury. Injury without such ligation is not followed by separation of the tendon; neither does the tendon rupture when trauma is combined with tendon sheath ligation or with single ligation. Therefore, in the rabbit at least, McMaster has assumed that there must be some blood traversing the tendon. From this data it may be inferred that rupture of a tendon can occur after minimal trauma in a tendon weakened by disease, previous trauma or an aseptic necrosis resulting from vascular obstruction during previous injury. Many authors [*6,8,11,14*] believe that chronic tenosynovitis most frequently precedes rupture. This was noted in our patient. They have also stated that swelling, inflammation and aseptic necrosis predispose to rupture of the tendon after trivial trauma.

Most reported cases of post-traumatic spontaneous subcutaneous rupture of the tendon are associated with fractures or subluxations [*4,5,10,12,14,15,17*]. In these cases rupture has occurred in twelve days to seven years after injury, with most separations falling in the two- to seven-month interval [*3*]. Females appear to be affected more often than males. An incidence of one rupture occurring in 250 Colles' fractures has been reported [*5*].

Because our patient does not have an underlying background of fracture or chronic tendon

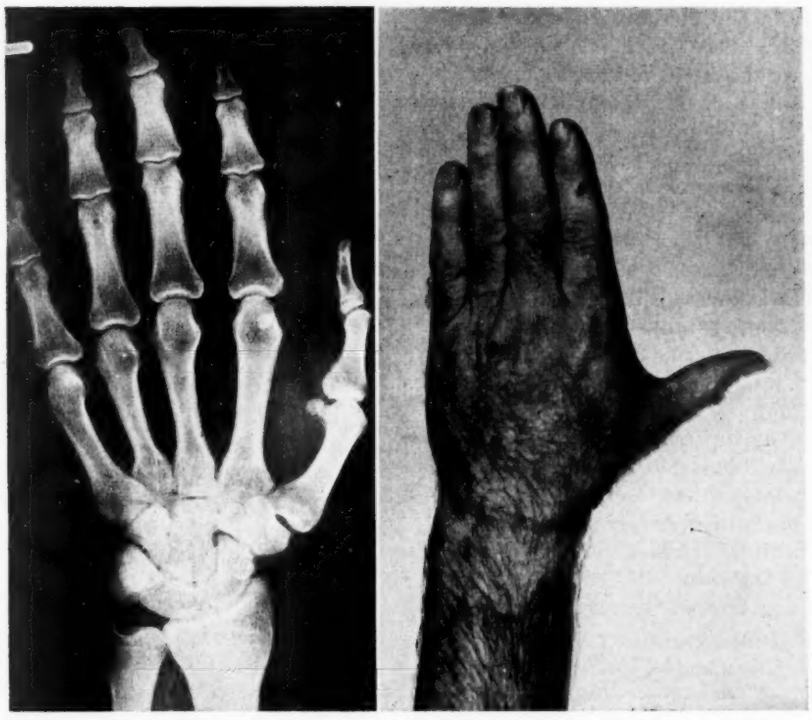

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FIG. 1. X-ray following rupture of the extensor pollicis longus tendon revealing normal bone structure of the wrist.

FIG. 2. Four months' postoperative result revealing thumb in nearly normal extension.

disease it was thought to be of sufficient interest to be reported. Honigmann [*8*] has reported a similar case among twenty-four cases in the German literature, at least nineteen of which were associated with fractures or subluxations. Posch et al. [*14*] report one case not associated with fractures at the wrist.

The tendon of the hand which is most apt to rupture in patients with rheumatoid arthritis is the extensor digitorum communis, usually to the last two or three digits [*1,2,16*]. The extensor pollicis longus tendon is most frequently associated with post-traumatic ruptures. This may be due in part to its anatomical configuration [*17*]. This tendon is exposed to the surface as it courses obliquely, traveling in its own compartment in the dorsal carpal ligament. It forms the ulnar border of the anatomical "snuff box" as it extends to insert into the base of the ungual phalanx of the thumb. In a large part the relative frequency of its rupture is probably due to its relation to the distal radius, the latter being most often involved in fractures at the wrist.

CASE REPORT

W. M., a thirty-seven year old mounted policeman, was admitted to the Philadelphia General Hospital on February 11, 1957, complaining that he could not "straighten" his left thumb. He stated that eleven months before he had been kicked on the back of his left wrist by a horse. At that time he was brought to the accident ward and was found to have marked swelling and tenderness involving the dorsum of the hand and wrist. There was no loss of motion of the thumb or fingers but movement of the wrist was painful. A fracture was suspected because of the marked swelling but this was not demonstrated by x-ray. A volar splint was applied, however, and the patient was instructed to return in three weeks for repeat x-ray to rule out carpal navicular fracture. These films were also normal. (Fig. 1.) No cortical cracking or roughening was shown. At the time the swelling and tenderness had disappeared. Full range of motion of the wrist, fingers and thumb was possible without pain. The splint was discarded and the patient was permitted to return to work four weeks after the injury.

He remained comfortable despite rigorous duty until December, 1956, nine months after injury

He noted then that the cold weather seemed to cause a return of the discomfort in his wrist. The pain and swelling reappeared and became so bothersome that he returned for outpatient medical care on December 27, 1956. He was advised to apply heat locally and to rest the extremity. The symptoms grew worse, however. In late January he noted that movements of his left thumb had become "awkward." The day before admission, while turning a page in a book, he heard a "snap" and found he could not extend his left thumb.

On examination, the terminal phalanx of the left thumb was flexed and could not be actively extended. There was a palpable depression at the medial border of the anatomical "snuff box" where the tendon of the extensor pollicis longus can usually be easily felt. There was no tenderness and no sensory or other motor loss.

Operation was performed on February 16, 1957, utilizing a pneumatic tourniquet. A transverse incision was made in the skin crease on the dorsum of the wrist and was curved distally through the anatomical "snuff box" as far as the mid-point of the first metacarpal. As the incision was deepened, the superficial cutaneous branches of the radial nerve were retracted. The dorsal carpal ligament was incised over the tunnel occupied by the extensor pollicis longus. The proximal end of the tendon was found to have retracted 2 to 3 cm. The end was bulbous and had become rather firmly adherent to the surrounding structures for a distance of 1 cm. The tendon was freed and the portion which had been adherent was excised. The distal tendon was dissected free revealing a distraction between the two cut ends of 5 to 6 cm. There was no bony or ligamentous roughening seen in this area.

A tendon graft was prepared by excising the left palmaris longus tendon with its tendon sheath. Two small transverse incisions were used for this purpose. An incision was placed along the ulnar side of the thumb. The distal end of the ruptured tendon was detached and the tendon graft inserted. The insertion was accomplished by a single mattress suture of fine wire secured to the short fragment of tendon attachment which remained. The graft was threaded along the normal bed of the long thumb extensor and was secured to the proximal tendon by means of a single figure-of-eight suture of fine wire. During the repair the thumb and wrist were held in extension. The soft tissues were carefully closed over the tendon graft with greatest attention to the proximal end of the "snuff box" where scar tissue existed. In this area normal tissue was pulled over the suture line.

The thumb and wrist were splinted in extension for three weeks. Guarded exercises were then begun and after two weeks the splint was discarded and more vigorous physical therapy was instituted.

Within four months of the repair the patient had regained normal function. (Fig. 2.) He was last seen one year after the operation at which time the thumb was capable of a completely normal range of motion. He has returned to his former job.

COMMENTS

Rupture of a tendon following non-penetrating trauma is rare when it occurs without injury to the underlying bone, yet in this patient the relation between the original direct blow over the tendon and its eventual rupture seem to be undeniable. The usual course is an injury to the underlying radius or carpal navicular producing a sharp edge over which the tendon must glide in its tight compartment. In this patient a fracture of the contiguous bone was adequately ruled out. In the absence of an obvious fracture, cortical roughening or cracking due to the blow could produce eventual separation of the tendon by attrition. This is the mechanism at fault when arthritic changes in the wrist joint are present. No evidence of such changes was found on x-ray or at operation in this instance.

It is conceivable that the severe blow from the horse's hoof so damaged the tendon that exertion over a long period of time caused the rupture. While this patient's occupation involving long hours on horseback has not previously been incriminated as a form of chronic overuse of the thumb extensor tendons (such as occurs in drummer's palsy, etc.), the chronic strain of the weakened tendon could have led to its rupture. The initial swelling of the tendon due to edema and hematoma formation could have been sufficient to produce ischemia with necrosis of the injured segment.

Despite the initial recovery and return of function after three weeks of immobilization, continued overuse of the tendon caused a chronic tenosynovitis such as has been reported in "drummer's palsy." The return of local pain and tenderness preceded rupture by eight to ten weeks. During this period immobilization of the tendon probably would have prevented its separation.

This experience has taught us to respect non-penetrating soft tissue injuries when tendons are involved. The extremity should be immobilized. Swelling should be controlled by such measures as elevation of the part and drainage of hematoma if present. Tight dressings should be avoided. Upon return of func-

tion, if local signs of inflammation reappear, the injured extremity should be reimmobilized and a prolonged period of rest planned.

If the tendon ruptures despite these measures, operative repair will give excellent results. The damaged tendon ends should be excised and a tendon graft inserted. End-to-end suture of the divided tendons is not feasible.

SUMMARY

A case history is reported of spontaneous rupture of the extensor pollicis longus tendon eleven months after blunt trauma to the wrist. There were no associated fractures of underlying bones or arthritic changes to account for the rupture. It is postulated that the tendon was weakened due to impairment of its blood supply and that it subsequently separated due to chronic overuse. It is recommended that blunt trauma to tendons should be treated more aggressively than at present with such measures as immobilization and elevation in order to avoid local swelling and ischemia.

This patient was successfully treated by means of a tendon graft. Tendon ruptures are briefly reviewed.

REFERENCES

1. Addison, N. V. Spontaneous ruptures of extensor tendons at the wrist joint. *Brit. J. Surg.*, 41: 511, 1954.
2. Barnes, C. K. Spontaneous rupture of the extensor pollicis longus. *J. A. M. A.*, 87: 663, 1926.
3. Bunnell, S. Surgery of the Hand, pp. 482, 668–669. Philadelphia, 1948. J. P. Lippincott & Co.
4. Christopher, K. Rupture of extensor pollicis longus tendon following Colles' fracture. *J. Bone & Joint Surg.*, 35-A: 1003, 1953.
5. Coburn, D. E. Delayed rupture of the extensor pollicis longus tendon following Colles' fracture. *Am. J. Surg.*, 68: 234, 1945.
6. Haldeman, K. D. and Soto-Hall, R. Injuries to muscles and tendons. *J. A. M. A.*, 104: 2319, 1935.
7. Harris, R. Spontaneous rupture of the extensor pollicis longus as a complication of rheumatoid arthritis. *Ann. Rheumat. Dis.*, 10: 298, 1951.
8. Honigmann, F. Die traumatische Spatruptur der Sehne des langen Daumenstreikers. *Med. Klin.*, 22: 728–731, 1926.
9. Hunt, J. R. Paralysis of the ungual phalanx of the thumb from spontaneous rupture of the extensor pollicis longus, the so-called "drummer's palsy." *J. A. M. A.*, 64: 1138, 1915.
10. Levine, J. and Schneider, M. Spontaneous rupture of the extensor pollicis longus tendon following the fracture of the carpal navicular bone. *J. Bone & Joint Surg.*, 37-A: 364, 1955.
11. Mason, M. L. Rupture of the tendons of the hand with a study of extensor tendon insertions in the fingers. *Surg., Gynec. & Obst.*, 50: 611, 1930.
12. McMaster, P. E. Late ruptures of the extensor and flexor pollicis longus tendon following Colles' fracture. *J. Bone & Joint Surg.*, 14: 93, 1932.
13. McMaster, P. E. Tendon and muscle ruptures; clinical and experimental studies on causes and location of subcutaneous ruptures. *J. Bone & Joint Surg.*, 15: 705, 1933.
14. Posch, J. L., Walker, P. J. and Miller, H. Treatment of ruptured tendons of the hand and wrist. *Am. J. Surg.*, 91: 669, 1956.
15. Trevor, D. Rupture of the extensor pollicis longus tendon after Colles' fracture. *J. Bone & Joint Surg.*, 32-B: 370, 1950.
16. Vaughn-Jackson, O. J. Rupture of extensor tendons by attrition at the inferior radio-ulnar joint; two cases. *J. Bone & Joint Surg.*, 30-B: 528, 1948.
17. Weinberg, E. D. Late spontaneous rupture of the extensor pollicis longus tendon following Colles' fracture. *J. A. M. A.*, 142: 979, 1950.

Coincident Bilateral Chylothorax and Chylous Ascites

REVIEW OF THE LITERATURE AND CASE REPORT

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THE problems of chylothorax and chylous ascites, whether of traumatic or non-traumatic origin, are unusual in the lives of most physicians. Apparently, however, these conditions are increasing in frequency due to automobile injuries, on the one hand, and to new surgical operations in the region of the thoracic duct, on the other hand. In recent decades various investigators have been able to describe and classify various types and etiologies of these manifestations of disease. Others have made significant contributions in the therapy of these difficult problems. Some cases, however, remain of obscure origin and are resistant to modern methods of treatment. The following is a report of such a case. It was referred to by Loe in his discussion of Brewer's paper, but has not been reported in detail before [*1*].

CASE REPORT

The patient, a thirty-seven year old white, married poultry laborer, was referred to the King County Hospital for evaluation of bilateral chylothorax and chylous ascites. He dated the onset of his illness to the spring of 1954. At that time he noted malaise, weakness, some dyspnea and muscle wasting with no weight loss. There was a history of mild trauma to his back, but he could not definitely date its occurrence to before or after the onset of the aforementioned symptoms. It was of such a mild character that he did not stop working on the day it occurred. During the summer dyspnea gradually increased in severity until October, 1954, when incapacity caused him to see his private physician. During the next two months there was progressive symptomatology. Early in December, 1954, both thoracentesis and paracentesis produced milky fluid.

The only other remarkable item in the history was the presence of an edematous left hand and forearm since birth which was otherwise normal in development and function. He was admitted to the King County Hospital on December 14, 1954.

Physical examination revealed that the blood pressure was 125/85 mm. Hg; pulse, 80; respirations, 20: and temperature, 98.6°F. The head, eyes, ears, nose and throat were negative for abnormalities. The thyroid was normal in size and consistency and there were no masses or nodes. The chest was barrel-shaped. There was dullness to percussion posteriorly on the right and to the level of the fifth rib, and less high on the left. Breath sounds in these areas were very distant. Examination of the heart revealed no abnormalities. The abdomen was markedly protuberant, with diastasis recti and fluid wave present. No organs or masses were noted, and there was no tenderness. Rectal examination was negative and the genitalia were normal.

The left forearm and hand were swollen and pitted to finger pressure.

Laboratory studies gave the following results: The Kline test was negative, as was urinalysis. The hematocrit was 47 per cent and the white blood count was 9,700 per cu. mm. The differential blood count showed a mild shift to the left. Total protein was 5.6 gm. per cent and albumin, 3.2 gm. per cent. Prothrombin time was normal; cephalin flocculation, bromsulphalein® and alkaline phosphatase tests were all normal. Total cholesterol was 146 mg. per cent. Stool guaiac was negative.

Studies on aspirated fluid varied slightly from time to time, but these findings are representative: specific gravity, 1.017; 600 red blood cells; 20 white blood cells; total protein, 2.6 gm. per cent; albumin, 1.5 gm. per cent. Culture was negative for routine organisms, acid-fast bacilli and fungi. Smears of

the sediment were negative for malignant cells. On fat droplet staining, "dried sample appears to be all fat." The total fat by weight was 3.4 per cent.

Chest x-rays showed bilateral hydrothorax greater in the right side of the chest than the left, and an elevated diaphragm. Films taken after thoracentesis showed no evidence of pulmonary disease. Upper gastrointestinal series, intravenous pyelogram, barium enema, and left subclavian venogram were all negative.

Table 1 is the record of the numerous aspirations from both the pleural and peritoneal cavities.

At the first operation, on January 10, 1955, exploratory laparotomy was performed. The following description is taken from the operative report:

"A measured 2000 cc. of milky fluid was aspirated from the peritoneal cavity. The peritoneal serosal surfaces in general were smooth and glistening. The liver, gallbladder, stomach, esophageal hiatus, spleen, kidney, inguinal regions, pancreas, small and large bowel were all within normal limits. Interspersed on the peritoneal surfaces on the posterior abdominal wall were several small bleb-like sacs, which were white in appearance. On breaking these saccules, a white fluid like that present in the peritoneal cavity was seen to exude. Preoperatively, and during the procedure, methylene blue had been inserted into the stomach by means of a gastric tube, and during the procedure 20 cc. of the dye was also injected into the jejunum. Although the lymphatic drainage of the small bowel was readily seen on the small bowel serosa, particularly in the upper small bowel, there was no bluish discoloration of these lymphatics or of the peritoneal cavity during the exploration. The retroperitoneal tissues were markedly thickened, and gave the impression that a retroperitoneal mass was present. However, on cutting the tissue for biopsy purposes, the tissue appeared only to be rather firm fibrous tissue with an excessive amount of fat present within it. This marked thickening was particularly noticeable from about the level of the ligament of Treitz down to about the level of bifurcation of the aorta. The lesser peritoneal sac was explored but nothing of import was seen. The microscopic report of the biopsy of the retroperitoneal tissue showed: 'fibro-fatty tissue showing mild chronic inflammation and dilated vascular channels. Some of the latter may represent lymphatics, although this is not demonstrable with certainty.'"

At the second operation, on February 1, 1955, right thoracotomy was performed and 1,500 cc. of milky fluid was aspirated. In the region of the azygos vein superiorly was a small bleb containing milky fluid. No sign of persistent leakage of chyle was seen. The thoracic duct was not visualized. All of the tissues from the vertebral bodies to the thoracic aorta were encompassed with a suture of No. 2-0 silk. The right phrenic nerve was crushed.

From this time on (Table 1) no chyle was aspirated from the right thorax.

At the third operation, on February 24th, left thoracotomy was performed with transdiaphragmatic explorations of the region of the cisterna chyli. The thoracic duct and cisterna chyli were not visualized. The tissue in this area was ligated. The dome of the pleural cavity was explored and found to be negative.

From this time on (Table 1) no significant amount of chyle was aspirated from the left side of the chest, but the rate of accumulation of ascitic fluid seemed to increase.

At the fourth operation, on March 25, 1955, exploratory laparotomy was again performed. The region of the cisterna chyli was again explored with

TABLE 1
RECORD OF PARACENTESES AND THORACENTESES IN THE AUTHORS' PATIENT

Date	Paracentesis (cc.)	Thoracentesis	
		Right (cc.)	Left (cc.)
12/5/54	.....	3000	.....
12/7/54	400	.....	.....
12/14/54 (Admitted to hospital)	.....	.....	.....
12/16/54	.....	2000	.....
12/21/54	2000	3000	.....
12/31/54	3000	4000	.....
1/7/55	2000	.....	.....
1/8/55	3000	.....	2000
1/10/55 (Day of laparotomy)	2000	.....	.....
1/18/55	1500	.....	.....
1/28/55	1350	.....	.....
1/29/55	.....	1400	.....
1/31/55	.....	500	1300
2/1/55 (Right thoracotomy, ligation on right side)	1500	1500	.....
2/2/55	.....	.....	500
2/4/55	.....	.....	950
2/9/55	.....	.....	1000
2/10/55	2400	.....	.....
2/14/55	3000	.....	.....
2/15/55	.....	.....	1000
2/16/55	1900	.....	.....
2/20/55	2850	.....	.....
2/24/55 (Left thoracotomy)	3350	.....	1100
3/7/55	4000	.....	.....
3/13/55	4400	.....	.....
3/19/55	4325	.....	.....
3/25/55 (Laparotomy)	4100	.....	.....
3/26/55	2600	.....	.....
4/6/55	600	.....	25
4/8/55	1000	.....	.....
4/13/55	300	.....	.....
Total	51,575	15,400	7875
4/16/55 (Autopsy)*	2500 (Chylous fluid)	1000 (Did not appear to be chylous fluid)	1500 (Did not appear to be chylous fluid)

* Patient died on same day.

no evidence of a duct being found. "Direct skyblue" dye was injected into the muscularis and submucosa of the jejunum at the onset of the procedure but it showed no sign of collecting in any structure resembling a duct.

The patient's course following this procedure was progressively downhill and on April 16, 1955, after a short period of respiratory difficulty, he quietly died.

The postmortem examination was performed on the day of his death. The left pleural cavity contained 1.5 L. and the right, 1 L. of pink-amber fluid which did not appear to be chyle. The sutures which had been placed at the second and third operations were found, but there was no evidence of the thoracic duct in the region of the upper abdomen, posterior mediastinum, or in the neck. At the junction of the left subclavian vein and internal jugular veins a few fragile vessels entered but none of these could be construed as thoracic duct. There was no evidence of a right thoracic duct. The right and left subclavian veins were opened. There was no thrombosis.

The abdominal findings were the same as those noted at the first and fourth operations except that they had advanced with more marked thickening of the retroperitoneal structures, the mesentery and the wall of the small bowel.

Microscopic examination of the retroperitoneal tissue was the same as that of the biopsy at the first laparotomy.

Sections of the small bowel were interpreted as showing chronic lymph stasis. Sections of the liver showed widening of the spaces between the liver cells. Lung sections showed details of recent bronchopneumonia with dilatation of lymphatic channels along vascular or bronchial walls.

Final summary of the autopsy listed chylous ascites and bilateral chylothorax of undetermined etiology. Bronchopneumonia was regarded as the terminal factor in the patient's death.

COMMENTS

This case represents an unusual variant of the problems of bilateral chylothorax and chylous ascites. Its etiology remains obscure. The possibility that trauma may have been important must be considered; however, its role historically was vague, and at postmortem examination one might expect to find some remnant of duct above or below the site of the trauma. The slow initial rate of fluid accumulation would also argue against a traumatic beginning.

The presence of the edematous left forearm and hand since birth suggested an unusual congenital anomaly, but this can remain only an intriguing conjecture based on the surgical and postmortem findings.

The cessation of the chylothorax following the transthoracic ligation of the structure in the posterior inferior mediastinum is an interesting aspect. Whether this was a result of ligation of major thoracic ducts or of many small lymphatic channels could not be determined, but the latter possibility appears most likely.

In reviewing the literature, the only similar case supported by autopsy would appear to be that of Griffith [2]. His patient also had bilateral chylothorax and chylous ascites for which no etiology could be determined. Careful dissection at postmortem examination, revealed no trace of a thoracic duct. It should be noted that in some cases in which malignancy appeared to be the cause of chylothorax and chylous ascites, the thoracic duct has not been found at autopsy [3–6].

Mason has classified some 118 cases of nontraumatic chylothorax; he included several cases from Wallis and Scholberg and from Yater [6–8]. The headings he used were: tuberculosis, carcinoma, lymphosarcoma, other tumors, vascular thrombosis, and miscellaneous. He was aware of Griffith's case but failed to classify it. Perhaps another category should be used—idiopathic—so that Griffith's case and the one reported herein may be included.

Chyle may be found in the pleural and peritoneal cavities secondary to trauma or to a variety of conditions as outlined by Mason. Whittlesey has listed the following causes as pertaining particularly to childhood: "(1) enlargement of mediastinal nodes by tuberculosis, Hodgkin's disease, etc., (2) miscellaneous new growths within the mediastinum, (3) filariasis, (4) bilharziasis, (5) trauma, (6) in association with an acute abdomen, (7) as a result of direct surgical trauma to the thoracic duct or cysterna chyli. In addition, there is the distinct possibility of, (8) congenital maldevelopment of the central or peripheral lymphatics, wherein a stenosis or atresia of these structures may well give rise to accumulation of chyle within the body cavities early in infancy [9]." Many of these also apply to the adult [10–12].

While one cannot differentiate etiologically, chylous ascites and chylothorax from those cases in which they occur together, for interest's sake, the English literature has been reviewed for cases of the latter type.

In 1911, Wallis and Scholberg presented a comprehensive survey of chylous and pseudo-

TABLE II

SUMMARY OF CASES OF COINCIDENT CHYLOTHORAX AND CHYLOUS ASCITES (FROM WALLIS AND SCHOLBERG, 1911 [7])

Author	Etiology	Age	Chylothorax (Unilateral or Bilateral)	Condition of Duct	Course
Rokitansky, 1865	"Morbus cordis"	65	Bilateral	Obstructed and dilated	Death
Quincke, 1875	Fractured ribs, traumatic	50	Right	Questionable	Death
Reichenbach, 1891	Lymphosarcoma	58	Right	Questionable	Death
Zawadzky, 1891	Carcinoma of stomach	67	Questionable side	Thrombosis of left subclavian vein	Death
Leydhecker, 1893	Carcinoma of pylorus	39	Bilateral	Duct infiltrated with growth	Death
Turney, 1893	Carcinoma of pylorus	54	Right	Thrombosis of left subclavian vein, duct dilated	Death
Senator, 1895	Carcinoma of ovary	47	Bilateral	Duct obstructed by metastasis	Death
Lenhartz, 1895	Peritoneal carcinoma	....	Left	Duct infiltrated by growth	Death
Corselli and Frisco, 1896	Retroperitoneal sarcoma	....	Bilateral	Duct not obstructed	Death
Corselli and Frisco, 1896	Carcinoma, primary (questionable)	24	Bilateral	Not mentioned	Death
Merklen, 1897	Cirrhosis of liver, trauma	61	Left	Not mentioned	Death
Sarrazin, 1897	Carcinoma of ovary	....	Questionable side	Obstructed in region of cisterna chyli	Death
Mackie Whyte, 1897	Questionable tuberculosis	21	Bilateral	Obstructed in neck by enlarged glands	Death
Michelli and Mattirolo, 1900	Questionable chronic peritonitis	....	Bilateral	Not mentioned	Death
Michelli and Mattirolo, 1900	Undetermined	....	Bilateral	Not mentioned	Death
Jousset, 1900	Tuberculosis	38	Bilateral	Duct normal	Death
Witte, 1901*	Undetermined	Adult	Questionable side	Questionable	Cure
Menetier and Gauckler, 1902	Carcinoma of stomach	53	Bilateral	Thrombosis of subclavian vein, duct involved with metastasis	Death
Achard and Laubry, 1902†	Cirrhosis of liver	44	Right	Normal	Death
Bayer, 1902	Cirrhosis of liver	....	Right	Questionable tuberculosis of thoracic duct, enlarged cervical nodes	Death
Clarkson, 1903	Carcinoma of liver	25	Left	Cisterna involved with growth	Death
Bernert, 1903	Lymphosarcoma	51	Bilateral	Not mentioned	Death
Zorab and Daw, 1904	Sarcoma	35	Bilateral	Not mentioned	Death
Wilson, 1905	Lymphosarcoma	35	Questionable side	Not mentioned	Death
Zypkin, 1906	Tuberculosis	....	Right	Not mentioned	Death
Leschtschinski, 1907	Carcinoma of pancreas	57	Left	Obstructed by thrombus at level of hiatus	Death
Doek, 1907	Lymphosarcoma	59	Right	Duct obstructed throughout its length	Death
Fellner, 1907	Questionable lymphadenoma	26	Right	Duct normal	Death

* See text.
† Doubtful case.

TABLE III

SUMMARY OF OTHER COLLECTED CASES OF COINCIDENT CHYLOTHORAX AND CHYLOUS ASCITES*

Author	Etiology	Chylothorax (Unilateral or Bilateral)	Condition of Duct	Course	Comments
Shaw, 1899 [13]	Lymphoma	Bilateral	Patent, thrombus at orifice into subclavian vein	Death	
Outland, 1916 [3]	Carcinoma of stomach	Left	Duct not found at autopsy	Death	
Gordinier, 1920 [14]	Obscure, questionable luetic	Bilateral	Questionable	Cure	Treated by aspiration
Coley, 1924 [4]	Lymphoma	Right	Not found at autopsy	Death	Relieved for short time by x-radiation
Ruddell, 1927 [5]	Probably tuberculosis	Bilateral	Not found at autopsy	Death	
Lyter, 1927 [15]	Questionable carcinoma of testis	Left	Not discussed in report	Death	
Cohn, 1931 [16]	Lymphoma	Questionable	Not discussed in report	Death	
Fletcher, 1932 [17]	Questionable carcinoma of gastrointestinal tract	Bilateral	Not discussed in report	Death	
Heppner, 1934 [18] and Brown, 1937 [19]	Trauma	Bilateral	Rent in duct 25 cm. above cisterna	Death	
Harrell, 1939 [20]	Carcinoma of stomach	Bilateral	Duct patent, but obstructed in neck	Death	
Little, 1942 [21]	Idiopathic thrombosis of subclavian vein	Left	Not known	Unimproved	Progressively deteriorated but alive; treated with intravenous chyle
Bauer, 1946 [22]	Thrombosis of left subclavian vein	Bilateral	Patent throughout, but at its orifice	Death	
Griffith, 1948 [2]	Undetermined	Bilateral	Duct not found at autopsy	Death	
Palken and Weller, 1951 [23]	Thrombosis of left subclavian vein	Right	Patent except at outlet	Death	
Blood and Fairchild, 1953 [24]	Undetermined (infant)	Right	Questionable	Cure	Treated with aspiration and low fat diet
Mason, 1953 [6]	Reticulum sarcoma	Bilateral	Duct not found at autopsy	Death	
Fernandes et al., 1955 [25]	Undetermined (newborn)	Right	Questionable	Cured	Treated by aspiration
Brewer (Case v), 1955 [1]	Undetermined	Questionable bilateral	Questionable	Unimproved	Treated by aspiration
Brewer (Case vi)	Retroperitoneal neurofibroma	Left	Obstructed by tumor	Cure	Treated by anastomosis of duct to vein at level of cisterna
Brewer (Case xv)	Undetermined	Questionable bilateral	Undetermined	Death	
Brewer (Case xvi)	Undetermined	Questionable bilateral, also weeped chyle from thigh	Undetermined, dilated retroperitoneal lymph channels	Unimproved	
Brewer (Case xvii)	Lymphosarcoma	Questionable	Undetermined	Death	X-ray failure
Brewer (Case xviii)	Lymphosarcoma	Questionable	Undetermined	Death	X-ray failure
Listerud et al., 1956	Undetermined	Bilateral	Duct not found at autopsy	Death	

* Not included in review by Wallis and Scholberg, 1911 [7].

NOTE: Not all of the thirty-three patients with both chylothorax and chylous ascites, collected by Nix, Albert, Dugas and Wendt in 1957 [33] are included in this table.

chylous ascites and in this article some twenty-eight cases are found [7]. Table II summarizes these cases. All but one of these patients died; that patient received fifty-nine paracenteses in about two year's time with the removal of some 700 L. of fluid. The diagnosis was never established.

In addition, some twenty-four other cases, including the one in this report, have been reviewed and the pertinent findings are tabulated in Table III. Only seven of these patients were still alive at the time their cases were reported, and only four were apparently cured.

The finding that in some cases the only obstruction to the flow of chyle is found at the orifice of the thoracic duct into the subclavian vein is confusing, for most cases of traumatic chylothorax are cured by ligation of the duct below the site of rupture and experimentally the thoracic duct may be ligated without the production of chylous effusions [26].

THERAPY

This report is not meant to be a complete discussion of the therapy of thoracic duct lesions; however, a few lines are in order regarding this aspect of the subject. Before 1946, the common practice was to aspirate the chyle from the chest or abdomen as its accumulation became distressing. Low fat, high protein diets, x-ray therapy, and phrenic nerve crush were all used in generally unsuccessful attempts to cure. Little, Harrison and Blalock reported the successful infusion of aspirated chyle [21]. Whitcomb and Scoville, and others, have reported instances of sudden death during the infusion of chyle and during recent years this technic has largely been abandoned [27–29].

In 1946, Loe [30] described the first case of chylothorax cured by ligation of the thoracic duct. In 1948, Lampson [31], reported the first successful transthoracic ligation of the duct for traumatic chylothorax. Brewer's comprehensive article [1] on the surgical management of thoracic duct lesions probably represents the most extensive experience in this field and the perusal of his paper is recommended to the reader. The use of lipophilic dyes in the diagnosis and treatment of these problems appears to be a valuable adjunct [32]. These authors also pointed out that ligation of the thoracic duct just above the diaphragm on the right will cure the majority of patients when the leak is above that point. Hence, such ligation will cure most cases of traumatic chylothorax. The recent comprehensive article by Nix, Albert, Dugas and Wendt in 1957 [33], reviewing 302 cases of chylothorax and/or chylous ascites, came to a similar conclusion, in that seventeen of nineteen of the patients with traumatic chylothorax were cured by ligation of the thoracic duct. In 1957, Giordano [34] also came to the same conclusion on the basis of experiments on dogs. However, Nix et al. concluded that a definitive therapy for chylous ascites is yet to be developed. On the other hand, Brewer [1] reported one case of chylous ascites successfully treated by anastomosis of (1) an afferent duct going to the cisterna chyli to (2) the hemiazygos vein

Nix et al. also pointed out that the incidence of chylothorax and chylous ascites is rising with the increase in such procedures as aortic grafts, cardiovascular surgery, and hepatic and pancreatic resections. In line with this observation, the recent report by Gaspar and Secrest in 1957 [35], of a case of chylothorax following translumbar aortography is of interest.

Chylous effusions are relatively rare in infants. In 1957, Feinerman, Burke, and Olsen [36] collected twenty-three cases from the literature and described two of their own. One of their patients died but the other was cured after one thoracentesis. Seaman [37] described a technic for elevating a disc of pleura about the site of the duct-to-pleura fistula and oversewing it. More recently Stranahan, Alley, Kausel, and Recue [38] have described a method of thoracic ductography and presented three cases in which its use was beneficial. Maurer [39] has reported the successful removal of the mediastinal thoracic duct for benign tumor with simple ligation of the superior and inferior ends of the duct.

Many articles in the literature describe chylothorax, others describe chylous ascites; however, the combination of the two is rare. Even rarer is the combination of bilateral chylothorax with chylous ascites. Such a "three cavity" chylous effusion was present in our case. In the report of Nix et al., there were four cases of their own which involved both chest and abdomen, but none was a "three cavity" involvement.

CONCLUSIONS

1. A survey of the literature indicates that most cases of traumatic chylothorax will be cured by (1) spontaneous closure of the leak within the thorax, (2) surgical closure or duct-to-vein anastomosis, or (3) ligation of the duct just above the diaphragm. In our patient,

bilateral ligation in the region of the duct just above the diaphragm did relieve the chylothorax.

2. In the rare instances of combined chylothorax and chylous ascites, idiopathic or congenital in origin, such ligations do not relieve the chylous ascites or may make it worse. These cases still present a difficult and unsolved problem in surgical therapy.

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REFERENCES

1. Brewer, L. A., III. Surgical management of lesions of the thoracic duct. *Am. J. Surg.*, 90: 210, 1955.
2. Griffith, R. L. Chylous ascites and chylothorax. *Northwest Med.*, 47: 800, 1948.
3. Outland, J. H. and Clendening, L. Chylous ascites and chylothorax. *J. A. M. A.*, 66: 1833, 1916.
4. Coley, B. L. Retroperitoneal lymphocytoma causing chylous ascites and chylothorax. *J. A. M. A.*, 82: 2031, 1924.
5. Ruddell, K. R. Chylous ascites and chylothorax due to lymphogranulomatosis of the mesentery and the receptaculum chyli. *Indianapolis M. J.*, 30: 213, 1927.
6. Mason, J. D., Jr. Bilateral chylothorax and chylous ascites due to reticulum cell sarcoma. *Boston M. Quart.*, 4: 117, 1953.
7. Wallis, R. L. M. and Scholberg, H. A. On chylous and pseudochylous ascites. *Quart. J. Med.*, 4: 153, 1911.
8. Yater, W. M. Non-traumatic chylothorax and chylopericardium. *Ann. Int. Med.*, 9: 600, 1935.
9. Whittlesey, R. H. Chylous ascites in childhood. *Ann. Surg.*, 142: 1013, 1955.
10. Davis, C., Jr., Young, K. C. and Kirby, W. J. Chyle peritonitis with acute small bowel obstruction. *Surgery*, 38: 393, 1955.
11. Hoffman, W. Free chyle in the acute abdomen: so-called chyle peritonitis. *Surg., Gynec. & Obst.*, 98: 209, 1954.
12. Boyd, D. and Wooldridge, B. F. Chylous ascites, a postoperative complication. *Labey Clin. Bull.*, 9: 105, 1955.
13. Shaw, H. B. Milky effusions in serous cavities: with a report on a case of chylous ascites and chylous hydrothorax. *J. Path. & Bact.*, 6: 339, 1899–1900.
14. Gordinier, H. C. The report of a case of true chylous effusions in the peritoneal and pleural cavities with recovery. *Albany M. Ann.*, 41: 328, 1920.
15. Lyter, J. C. Chylous ascites and chylothorax. *M. Clin. North America*, 11: 479, 1927.
16. Cohn, I. Chylothorax and chylous ascites. *Am. J. Surg.*, 11: 260, 1931.
17. Fletcher, E. G. A case of combined chylothorax and chylous ascites with extensive malignant involvement of the thoracic duct. *J. Florida M. A.*, 19: 204, 1932.
18. Heppner, G. J. Bilateral chylothorax and chyloperitoneum. *J. A. M. A.*, 102: 1294, 1934.
19. Brown, A. L. Traumatic rupture of the thoracic duct with bilateral chylothorax and chylous ascites. *Arch. Surg.*, 34: 120, 1937.
20. Harrell, G. T., Street, D. M. and Rieser, R. Chylothorax and chylous ascites. *J. Lab. & Clin. Med.*, 24: 1045, 1939.
21. Little, J. M., Harrison, C. and Blalock, A. Chylothorax and chyloperitoneum. *Surgery*, 11: 392, 1942.
22. Bauer, J. T. A case of chylothorax and chylous ascites with a review of lesions of the thoracic duct. *Bull. Ayer Clin. Lab., Pennsylvania Hosp.*, 3: 483, 1946.
23. Palken, M. and Weller, R. W. Chylothorax and chyloperitoneum. *J. A. M. A.*, 147: 566, 1951.
24. Blood, M. J. and Fairchild, R. C. Two cases of chylous ascites and chylothorax in infants with recovery. *J. Kansas M. Soc.*, 54: 108, 1953.
25. Fernandes, J., Van De Kamer, J. H. and Weijers, H. A. The absorption of fats studied in a child with chylothorax. *J. Clin. Investigation*, 34: 1026, 1955.
26. Lee, F. C. The establishment of collateral circulation following ligation of the thoracic duct. *Bull Johns Hopkins Hosp.*, 33: 21, 1922.
27. Whitcomb, B. B. and Scoville, W. B. Postoperative chylothorax. *Arch. Surg.*, 45: 747, 1942.
28. Schnug, E. and Ranshoff, J. Traumatic chylothorax: a case treated with intravenous chyle. *Surgery*, 14: 278, 1943.
29. Peet, M. M. and Campbell, K. N. Massive chylothorax following splanchnicectomy. *Univ. Hosp. Bull., Ann. Arbor*, 9: 21, 1943.
30. Loe, R. H. Injuries of the thoracic duct. *Arch. Surg.*, 53: 448, 1946.
31. Lampson, R. S. Traumatic chylothorax. *J. Thoracic Surg.*, 17: 778, 1948.
32. Klepser, R. G. and Berry, J. F. The diagnosis and surgical management of chylothorax with the aid of lipophilic dyes. *Dis. of Chest*, 25: 409, 1954.
33. Nix, J. T., Albert, M., Dugas, J. E. and Wendt, D. L. Chylothorax and chylous ascites: a study of 302 selected cases. *Am. J. Gastroenterol.*, 28: 40, 1957.
34. Giordano, L. On the surgical treatment of chylothorax due to traumatic lesions of the thoracic duct in the thorax: experimental research. *Minerva med.*, 48: 1515, 1957; abstract in *J. A. M. A.*, 165: 743, 1957.
35. Gaspar, M. R. and Secrest, P. G. Chylothorax as a complication of translumbar aortography. *Arch. Surg.*, 75: 193, 1957.
36. Feinerman, B., Burke, E. C. and Olsen, A. M. Chylothorax in infancy. *Proc. Staff Meet., Mayo Clin.*, 32: 314, 1957.
37. Seaman, J. B. A new technique in traumatic chylothorax. *J. Thoracic Surg.*, 27: 529, 1954.
38. Stranahan, A., Alley, R. D., Kausel, H. W. and Recue, T. S. Operative thoracic ductography. *J. Thoracic Surg.*, 31: 183, 1956.
39. Maurer, E. R. Complete extirpation of the thoracic duct. *J. A. M. A.*, 162: 135, 1956.

Basal Cell Carcinoma in Children

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MALIGNANT tumors of epithelial origin are uncommon during childhood as compared to tumors of mesenchymal origin. Sarcoma accounts for 97 per cent of malignant tumors in children but only 10 per cent of adult malignancies [6]. Ewing, quoted by Anderson [3], stated "that the sharp decline in the incidence of malignant tumors which are characteristic of childhood in the pre-sexual period, eight to fifteen years, is a fact of fundamental, biologic importance, suggesting that the causative factors of infancy have exhausted themselves and that, thereafter, new conditions of origin, new types of tumors may be expected, and precocious cases of adult tumors may begin to appear."

The occurrence of basal cell carcinoma in children is uncommon. In order to give an idea of its reported incidence, the following statistics are presented. The California Tumor Registry for the years 1942 through 1954, reporting on over 75,000 cases of malignant tumors of all types, stated that only 0.4 per cent of malignant skin tumors occur in those under fifteen years of age. For the year 1954, of 899 cases of basal cell carcinoma, only nine occurred in patients under fifteen. Memorial Hospital, New York, New York [4], in a study of 506 cases of cancer in childhood over a twenty-five year period, reported three malignancies involving the skin without mention as to type. In a survey over a thirty-year period at the Barnard Free Skin and Cancer Hospital, St. Louis, Missouri, Hall's [5] youngest patient with a basal cell carcinoma was twenty-two years old. Scharnagel and Pack [10], in a review of 1,374 patients with basal cell carcinoma at Memorial Hospital, New York, found the youngest patient to be seventeen years of age. Only 1.5 per cent were less than thirty years of age. These author's reported the case of a basal cell carcinoma on the chest of a five year old child following roentgen therapy over the thorax for treatment of a thymoma. There have been sporadic reports of spontaneous basal cell carcinoma occurring in children. Reye [8] reported

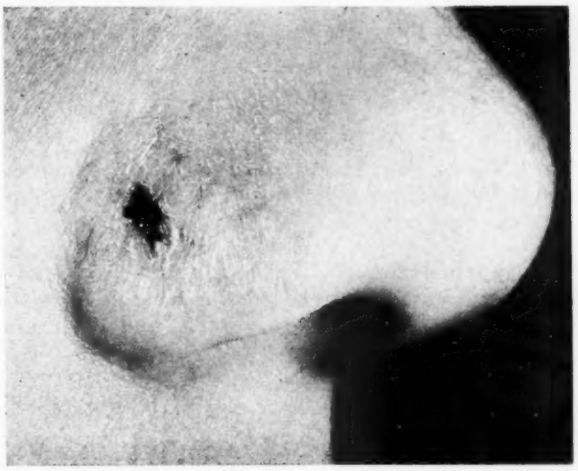

FIG. 1. Case 1. Basal cell carcinoma of nose.

a basal cell carcinoma in the nasolabial furrow occurring in a five year old girl; Sewell [9] reported one involving the scalp of a thirteen year old girl.

Herewith are presented three cases of basal cell carcinoma occurring in children under fifteen years of age.

CASE REPORTS

CASE 1. S. J. was an eleven year old girl who had a discoloration of the right ala since she was six weeks of age. (Fig. 1.) At five years, this area enlarged and was treated with a course of radium over a two-month period. One year before the writing of this report, skin planing was attempted by a dermatologist and finally a biopsy was performed; the tissue report was basal cell carcinoma. (Fig. 2.) The patient was referred to this office and under general anesthesia the lesion was widely excised and a full thickness postauricular skin

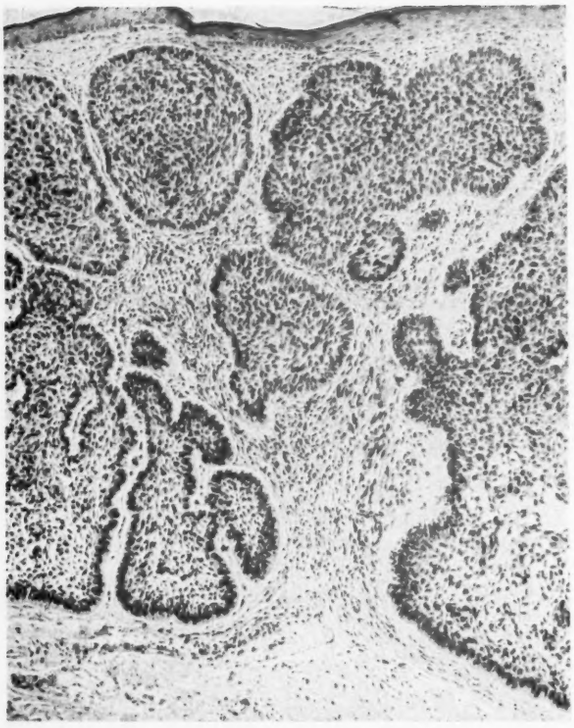

FIG. 2. Case 1. Photomicrograph of basal cell carcinoma. Original magnification × 200.

graft applied to the defect. Pathological report showed typical basal cell carcinoma excised with adequate margins. The patient has had no recurrence of the disease for the previous eight months and has a good cosmetic result.

CASE II. J. R., a fourteen year old boy, noted a lesion on the center of his forehead approximately one year before the writing of this report. Biopsy of this lesion was reported as basal cell carcinoma. Under local anesthesia, he had a wide excision of the tumor and primary closure of the incision. Permanent tissue sections confirmed the diagnosis and wide clearance of the tumor. Follow-up examination at the end of one year revealed no recurrence of disease.

CASE III. S. B. was a fourteen year old schoolgirl who noted a crusted lesion on the left side of the philtrum of six months' duration. Because of the indolence of this lesion, an excision biopsy was performed and reported as basal cell carcinoma with margins cleared. There has been no recurrence of the tumor for the previous eighteen months.

COMMENTS

Basal cell carcinoma in young adults is not uncommon. In a study of 8,000 skin lesions of soldiers received at the Army Institute of Pathology for histologic review, 1,500 of these were basal cell carcinomas. Approximately 12 per cent of all skin lesions received at this central examining point were basal cell carcinomas [1]. The head and neck house 87 per cent of all basal cell carcinomas and the remaining 13 per cent is divided equally on the trunk and extremities [2]. The middle third of the face, the most common site from which this lesion arises, is also the area with the most active sebaceous glands. The role that these sebaceous glands play in the etiology of basal cell carcinoma is uncertain. Heredity has no part in the disease.

Metastases from basal cell carcinoma are very rare, there being approximately twenty authenticated cases reported in the literature. Lattes and Kessler [7] reported two cases of metastases from this lesion, the first involving the regional lymph nodes and later the viscera, ultimately causing death. It is significant that these cases were in young adults; one was a basal cell carcinoma on the wrist that appeared in a nineteen year old male and which resisted radium, roentgen rays, and finally surgery for eighteen years. The second case was that of a twenty-eight year old woman who succumbed from metastatic disease twelve years after the onset of a basal cell carcinoma of the scalp.

The suggested increased virulence of basal cell carcinoma in this young age group is further emphasized by Webster's [11] case of an eighteen year old patient with basal cell carcinoma of the nose. He presented himself eight years after the onset of his disease after having had radium, roentgen therapy, and electric desiccation of the lesion. He finally required thirty-five operative procedures to be rid of the disease. New lesions apparently developed in the course of time.

SUMMARY

Three additional cases of basal cell carcinoma appearing in children under fifteen years of age are presented. Although uncommon, this lesion is probably more prevalent in this age group than generally realized and has all the malignant potential or even more so than the tumor in the adult. Approximately 0.5 per cent to 1.0 per cent of basal cell carcinoma occurs in children under fifteen years of age. Prompt biopsy of all suspicious lesions

of the skin in children and appropriate excision and plastic repair are recommended before this lesion progresses to wide destruction.

Surgery provides a specimen that the pathologist can examine and establish the morphology and the clearance of the margins of the lesion. Radiation in children is somewhat hazardous because of the danger of arrest in growth of underlying bone. The resultant scar from radiation therapy is sometimes unsightly and requires plastic revision at a later date anyway.

REFERENCES

1. Allen, A. The Skin. St. Louis, 1954. C. V. Mosby Co.
2. Allen, A. Survey of pathologic studies of cutaneous diseases during World War II. *Arch. Dermat. & Syph.*, 57: 19–56, 1948.
3. Anderson, D. Tumors of infancy and childhood. *Cancer*, 4: 890–906, 1951.
4. Dargeon, H. Cancer in children from birth to 14 years of age. *J. A. M. A.*, 136: 459–468, 1948.
5. Hall, N. and Bagby, J. Carcinoma in the first three decades of life. *J. A. M. A.*, 110: 703–706, 1938.
6. Helmholz, H. Malignant neoplasms in childhood. *Proc. Staff Meet., Mayo Clin.*, 6: 721–724, 1931.
7. Lattes, R. and Kessler, R. Metastasizing basal cell epithelioma of the skin. *Cancer*, 4: 866–878, 1951.
8. Reye, K. Basal cell carcinoma occurring in childhood. *M. J. Australia*, 2: 62–65, 1954.
9. Sewell, R. Basal cell carcinoma in youth. *Arch. Surg.*, 42: 909–912, 1941.
10. Scharnagel, I. and Pack, G. Multiple basal cell epitheliomas in a five year old. *Am. J. Dis. Child.*, 77: 647–651, 1949.
11. Webster, J. The problem of reconstruction in potential persistent malignancy in a foresight saga. *Brit. J. Plast. Surg.*, 9: 289–303, 1957.

"Benjamin Rush was born in Byberry Township, near Philadelphia, of Quaker parents, in 1745. In 1760, at the age of fifteen years, he graduated at Princeton. He then served an apprenticeship of six years with a physician in Philadelphia, following which he went to Edinburgh. Two years later (1768) he took his M.D. degree. Followed a year in the hospitals of London and Paris. At the age of twenty-four Rush began the practice of medicine in Philadelphia. He conducted the chemistry class at the Philadelphia Medical College. In 1789 he began his lectures on the theory and practice of physic. When the Medical College he had helped to found was absorbed by the University of Pennsylvania (1791) he was given the chair of the institutes of medicine and of clinical practice. In 1796 he succeeded to the professorship of the theory and practice of medicine. Benjanin Rush's writings were many and varied. He wrote on many subjects outside of the realm of medicine. Professionally he is best known by the five volumes of 'Medical Inquiries and Observations' which appeared at intervals from 1789 to 1798. Rush was a friend of Franklin. He was a member of Congress from Pennsylvania in 1776. He was a signer of the Declaration of Independence. With James Pemberton he started the first antislavery society in America (1774). He was a member of the Pennsylvania convention which adopted the Federal constitution. We read of his splendid work when the yellow fever devastated Philadelphia (1793). He had two sons—one, James (1786–1869), a physician. Benjamin Rush contracted typhus fever and after a five days' illness died on the 19th of April, 1813." (T. S. W., *Am. J. Surg.*, 15: 168, 1932.)

Spontaneous Perforation of the Cecum without Mechanical Obstruction

REVIEW OF LITERATURE AND CASE REPORT

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THE purpose of this report is to call attention to spontaneous perforation of the cecum due to distention without demonstrable mechanical obstruction of the large bowel distal to the cecum.

Perforations of the cecum occur in patients in whom the cecum is directly involved as in injury from stab and bullet wounds, inflammatory lesions, carcinoma and volvulus. Aside from the perforations due to lesions which involve the cecum directly, the cecum perforates from distention in a manner not commonly seen in any other part of the gastrointestinal tract. This may be because of its relationship to the ileocecal valve which may or may not be competent. More will be said of this herein.

That the cecum is prone to rupture when it becomes overdistended as the result of remote obstruction of the more distal colon was first reported by Heschl [1] in 1880. This type of perforation has been called diastasic perforation of the cecum. In 1911, Shimodaira of Kocher's Clinic [2] collected forty-eight cases of perforation in conjunction with obstruction of the colon. Most of these perforations involved the cecum.

In 1935, Saeltzer and Rhoads [3] reviewed diastasic perforations up to that time. Among the factors they listed which favored ruptures of the cecum rather than other parts of the colon in obstruction of the large bowel was the thin wall of the cecum. They noted that the muscle of the bowel wall proximal to the obstructive lesion will hypertrophy but that this area does not extend to the cecum. They also drew attention to two other factors already mentioned, that the diameter of the cecum is greater than any other part of the colon, and the competency of the ileocecal valve. The role that a competent ileocecal valve plays in obstruction of the large bowel has been stressed in the literature. It is reasonable to expect that obstructions of the large intestine near the cecum would result in earlier perforation of the cecum than would obstructions occurring for example in the sigmoid. Also obstruction near the cecum in combination with a competent ileocecal valve might be expected to cause the most precipitous perforation. This would fall in the concept of the closed loop obstruction of Wangansteen [4].

How often is the ileocecal valve incompetent? The frequency varies in different studies. Using the reflux of rectally administered barium into the ileum as a measure of incompetency, Fleischer and Bernstein [5] found reflux to occur in 90 per cent of the cases while Ravid [6] found it to occur in 50 to 60 per cent.

Distention of the small bowel has been reported in only a few cases in which perforation of the cecum occurred. Dennis [9] cited one case in his series. Rack [7] reported distention of the small bowel in three of eight cases. He also noted that the cecum remains distended even after perforation.

Not only is the amount of pressure on the wall of the intestine important in perforation, but also the length of time of continuous application. Sperling [8] in 1938 found that

the continuous application of 10 cm. of water in a closed ileal loop of a dog for twenty-eight hours caused petechial hemorrhages in the bowel wall, but the bowel was still viable. When 20 cm. of water was applied for a similar period hemorrhagic infarcts and early areas of necrosis on the antimesenteric border of the bowel wall were found. A pressure of 40 cm. was tolerated only for seventeen hours before gangrene and necrosis set in.

In intestinal obstruction, the intraenteric pressure is greater in the large bowel than in the small bowel. This can be explained by the action of the ileocecal valve and by the large diameter of the colon. In 1944, Dennis [*9*] in his series of obstructions of the colon, found that the average pressure prior to colostomy was 14 cm. of water, the highest 34 cm. In his two cases of perforations, the pressure was 20 cm.

The effect of distention of the colon on the blood supply to the wall of the intestines has been observed in animals and on bowel wall in humans obtained from postmortem examinations. Von Zwalenburg [*10*] first studied the effect of distention on the blood flow in the intestinal wall. By means of a light in the lumen of the intestine he could observe the changes of blood flow microscopically. By increasing the pressure he could arrest blood flow first in the capillaries, then the veins, and finally at 130 mm. Hg the flow ceased entirely.

Gatch [*11*] found in closed loop experiments in dogs that for each increase in gas pressure within the lumen there was a corresponding decrease in volume of blood per minute circulating through the bowel wall. He found that a constant residual of blood flow remains however greatly the loop is distended. The residual circulation occurs by way of small anastomatic vessels in the mesentery and along the mesenteric border of the intestines.

In 1926 van Beuren [*12*] studied the pathological changes occurring in the bowel wall from distention which lead to necrosis and perforation. He found that the narrowing of the vessel's lumen and the thinning of the vascular wall from distention were greatest at the antimesenteric surface of the intestine. As the intraenteric pressure increases the vessels are finally occluded. Hemorrhagic infarcts and necrosis set in in those areas on the antimesenteric surface of the bowel.

FIG. 1. Distention of the large and small bowel.

Ravid called attention to the mechanical factor involved in perforations of the colon. When perforation occurs the intraenteric pressure causing the distention exceeds the tensile strength of the bowel wall. He lists the sequence of events leading to perforation of the colon as first, splitting of the taenia, then a longitudinal tear of the outer muscle wall, a circular tear of the inner muscle, and finally perforation of the mucosa.

When perforation of the cecum does happen the consequences are grave. In the Albers, Smith and Carter [*13*] series of perforations of the cecum due to colonic obstruction, the mortality rate was 72 per cent. Among the factors contributing to the high mortality is the fact that these patients are often elderly, and that carcinoma of the colon is the commonest cause of the obstruction. Another reason for the high mortality is that perforations of the cecum do not given an acute picture of abdominal pain, vomiting, and board-like abdomen as do perforations of the more proximal parts of the gastrointestinal tract. Consequently the clinician may be mislead into missing the diagnosis.

The case presented herein is a perforation of the cecum following distention of the large and small bowel after a caesarean section.

FIG. 2. Distended large and small bowel of patient in erect position. Note free air in peritoneum.

FIG. 3. Distended large and small bowel of patient in supine position.

FIG. 4. Barium passes to cecum readily.

No mechanical factor causing the obstruction was identified at the operation or afterward.

CASE REPORT

The patient's first admission to Carson C. Peck Memorial Hospital was on February 20, 1954 at the age of twenty-two. A lower segment transverse caesarean section was performed for cephalopelvic disproportion under 14 mg. pontocaine® spinal anaesthesia. A viable 8 pound baby was delivered. There was a moderate amount of bleeding during the operation. The patient received 500 cc. of blood. Immediately at the end of the operation she had quite a bit of wretching and vomiting.

On the second postoperative day her abdomen became softly distended. On the third day her abdomen was considerably distended and she began to vomit. Some flatus was passed through the rectum. Her abdomen remained distended. On auscultation of the abdomen tinkles were heard. Inspection of the incision revealed some staining at the upper angle.

X-ray film of the abdomen showed a considerable amount of gas in the small bowel and the large bowel down to the proximal sigmoid. (Fig. 1.) The cecum was markedly distended.

A Miller-Abbott tube was passed. The patient's incision was reopened as far down as the peritoneum for possible bowel herniation. No defect was found.

The Miller-Abbott tube was passed into the small bowel. The patient's distention was relieved. After this, her postoperative course was uneventful and she was discharged on the ninth postoperative day.

Her second pregnancy was uneventful until the time of her hospital admission on February 4, 1957. She was admitted in labor and with some

tenderness in the left lower quadrant of the abdomen. The estimated date of confinement was March 2, 1957. A lower segment caesarean section was performed under 800 cc. of 0.2 per cent sodium pentothal® anaesthesia. A viable baby weighing 6 pounds, 3 ounces was delivered. Again immediately postoperatively, wretching and vomiting were present.

On the first postoperative day she had slight distention. On the second day the distention increased. There was an elevation of temperature and the pulse was rapid. She passed some flatus through her rectum. Bowel sounds were heard on auscultation. She was given three injections of prostigmin.®

The patient did not tolerate the Miller-Abbott tube and removed it several times. The following day the abdominal distention increased. The degree of distention became tremendous. The distention caused the abdominal wall to describe a symmetrical curve from the costal arch to the pubic symphysis and from flank to flank. No surface contour of distended intestinal loops was present. She had marked difficulty in breathing because of the distention. Her respirations were labored and 52 per minute.

A flat plate of the abdomen revealed marked distention of the cecum. Also the colon was distended down to and including the sigmoid. Several loops of the small bowel were also distended with gas. Free air was shown in the abdomen and about the cecum indicating perforation of a hollow viscus. (Figs. 2 and 3.)

The old incision was reopened. A great quantity of air under pressure was released. Following this a large quantity of fluid exudate with fecal matter was aspirated.

The cecum was found to have seven perforations measuring from 4 to 7 mm. in diameter. Exploration of the right colon, hepatic flexure, transverse colon, splenic flexure and sigmoid did not reveal the cause of mechanical obstruction. The appendix was not involved. No adequate explanation for the perforation could be found such as an obstructing lesion of the colon. Volvulus of the cecum did not appear to have been present.

One of the perforations was selected for cecostomy. The other perforations were closed with a double layer of atraumatic No. 00 chromic catgut. A No. 40 open head mushroom catheter was placed in the cecum and secured with two atraumatic purse string sutures. The catheter was brought through a stab wound and secured to the skin. By means of the flange on the catheter, the cecum was approximated to the parietal peritoneum. A cigarette drain was placed in the pelvis and allowed to emerge through the central abdominal wound.

In the postoperative period, the patient received oxygen, antibiotics and intravenous fluids. A Miller-Abbott tube was passed. The cecostomy functioned after the third day. She gradually improved. On the fourth day, she passed flatus through her rectum, and two days later had a normal bowel movement. The cecostomy tube was removed on the thirteenth postoperative day and she was discharged on the fifteenth postoperative day.

A barium enema on the twelfth postoperative day showed that barium passed through the bowel readily. (Fig. 4.) Two loops of sigmoid appeared to be angulated and attached to the abdominal wall. This did not cause any hindrance to the passage of barium.

COMMENTS

The case presented in this paper is an unusual situation in which the cecum perforated postoperatively after a caesarean section. A mechanical factor responsible for the obstruction could not be found. The conditions most commonly associated with perforation of the cecum due to obstruction of another part of the colon are carcinoma, volvulus of the sigmoid and strictures due to adhesions.

In any obstruction, early diagnosis and appropriate treatment are imperative. When distention of the abdomen occurs, a long tube should be passed and x-ray films of the abdomen taken. Appropriate surgical intervention should be undertaken when indicated. Many of the patients with intestinal obstruction do pass flatus and sometimes fecal matter as this patient did. McCune and Keshishian [*14*] found that 40 per cent of their patients with intestinal obstructions passed some flatus or fecal matter through the rectum.

When the obstruction is located in the small bowel, vomiting is frequent and usual. However, when the obstruction occurs in the large bowel there may be little or no vomiting. Dennis in his series, showed that only one-half of his patients with obstruction of the colon vomited three times or more and only 7.8 per cent had fecal vomiting.

Impending rupture of the cecum can be diagnosed on x-ray examination of the abdomen according to Lowman and Davis [*15*]. They found that when the diameter of the cecum reaches 9 cm., there is danger of perforation. An incompetent ileocecal valve is no guarantee that perforation will not occur, as was shown in this and other cases.

A simple maneuver was described by Connell and Tovee [*16*] to relieve postpartum obstructions of the large bowel due to pressure of the enlarged uterus on the sigmoid colon at the level of the bony pelvis. Their treatment consisted of placing the patient in the knee-chest position, and while in this position, a finger placed in the rectum pushes the uterus out of the pelvis. The patient is maintained in the knee-chest position until the distention is relieved.

SUMMARY

A case of spontaneous rupture of the cecum following tremendous distention is reported. Neither a lesion involving the cecum nor any other obstructing lesion of the more distal colon could be found. A review of the literature does not reveal similar cases.

REFERENCES

1. Heschl, R. Mechanik der diastatischer Dormperfortionen. *Wien. med. Wcbnscbr.*, 30: 1, 1880.
2. Shimodaira, V. Experimentelle Untersuchungen über die Entstehung von sogenannten Dehüngsgeschwuere. *Mitt. a.d. Grenzgeb. d. Med. u. Cbir.*, 22: 229, 1911.
3. Saeltzer, D. V. and Rhoads, G. K. Diastasic perforation of the normal cecum. *Ann. Surg.*, 101: 1257–1263, 1935.
4. Wangensteen, O. H. Intestinal Obstructions, 3rd ed., p. 39. Springfield, Ill., 1955. Charles C Thomas.
5. Fleischer, F. G. and Bernstein, C. Roentgen anatomical studies of normal ileo-cecal valve. *Radiology*, 54: 43, 1950.
6. Ravid, M. J. Diastasis and diastasic perforation of G.I. tract. *Am. J. Path.*, 27: 33–57, 1951.
7. Rack, F. J. Obstructive perforation of the cecum. *Am. J. Surg.*, 84: 527–533, 1952.
8. Sperling, L. Mechanics of simple obstruction; experimental study. *Arch. Surg.*, 36: 778, 1938.
9. Dennis, C. Treatment of large bowel obstruction. *Surgery*, 15: 713–735, 1944.
10. Von Zwalenburg, C. V. Strangulation resulting from distention of hollow viscera, its bearing upon appendicitis; strangulated hernia, and gall bladder disease. *Ann. Surg.*, 46: 780, 1907.
11. Gatch, W. D., Trusler, H. M. and Ayers, K. D. Effects of gaseous distention of obstructed bowel; incarceration of intestine by gas traps. *Arch. Surg.*, 14: 1215, 1927.
12. van Beuren, F. J. The mechanism of intestinal perforation due to distention. *Ann. Surg.*, 83: 69, 1926.
13. Albers, J. H., Smith, L. and Carter, R. Perforation of the cecum. *Ann. Surg.*, 143: 251–255, 1953.
14. McCune, W. S. and Keshishian, J. M. Postoperative intestinal obstruction. *Surg., Gynec. & Obst.*, 96: 567–572, 1953.
15. Lowman, R. M. and Davis, L. An evaluation of cecal size in impending perforation of the cecum. *Surg., Gynec. & Obst.*, 103: 711–718, 1956.
16. Connell, D. E. and Tovee, E. B. Postpartum obstruction of large bowel. *Postgrad. Med.*, 21: 231–235, 1957.

Lipomas of the Stomach

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ACCORDING to the literature and recent textbooks of pathology, lipoma of the stomach is rare [*1,2,9,13,16*] and relatively unimportant [*4,7*]. Our disagreement with the latter concept stimulated us to write this article after encountering two cases of the condition within the past few years in the pathology department of our hospital.

A most extensive survey of the literature was made in 1951 by Palmer [*12*], who was able to collect 103 cases from twenty-three papers. We have been able to find twenty more cases in the literature since that date [*3,5,8,11,14,17*]. To these we wish to add two cases from this laboratory, one from the surgical service and the second discovered at autopsy after the patient had died of massive gastric hemorrhage. There are probably many other cases buried in the literature and in the files of pathology laboratories throughout the world.

CASE REPORTS

CASE 1. This fifty-six year old white man was admitted to the Morristown Memorial Hospital on December 13, 1956, with a tentative clinical diagnosis of recurrent myocardial infarction. In July, 1956, he had been hospitalized for five weeks with clinical and electrocardiographic evidence of a myocardial infarction. Prior to that date he had no symptoms referable to the gastrointestinal system and on that admission he was not anemic. This admission was preceded by chest pain and weakness of about four days' duration. The hemoglobin was 4.8 gm. per cent and the hematocrit 19 per cent on admission. The electrocardiogram showed no acute changes and the serum transaminase was 29 units (normal in this laboratory 10 to 40 units). It was concluded that the precordial pain was due to tissue hypoxia resulting from the anemia rather than further coronary disease, and accordingly the patient was given blood transfusions until his hemoglobin level was 12.0 gm. per cent. The precordial pain disappeared when the anemia was corrected. Repeat stool specimens showed occult blood and on several occasions it was noticed that the stools were black.

Gastrointestinal barium x-ray studies revealed the stomach to be in medium position and in it was a rounded pressure defect on the lesser curvature side of the antrum. This smoothly rounded density measured 4.5 cm. in diameter. It did not destroy the gastric mucosa and there was no evidence of ulceration. The mass moved with the stomach when the patient was in the upright position. There was no delay in emptying the duodenal bulb and the proximal jejunal loops were normal. Repeat gastrointestinal series (Fig. 1) two weeks later showed, in addition to the intramural tumor, evidence of a well defined ulcer crater at the apex of this defect. The laboratory studies preoperatively revealed a hemoglobin of 13.6 gm. per cent, white blood cell count 10,600 per cu. mm., polymorphonuclear leukocytes 56 per cent, lymphocytes 41 per cent, monocytes 1 per cent, eosinophils 2 per cent, blood sugar 97 mg. per cent, and blood urea nitrogen 11 mg. per cent. Urinalysis showed a specific gravity of 1.018 and no sugar or albumin.

A subtotal gastrectomy was performed without difficulty on January 5, 1957. In the prepyloric area there was an ovoid, semi-firm mass in the intramural tissue. In the unopened stomach it was possible to palpate an ulcer crater superimposed on this mass. There were no adhesions around the pylorus or duodenum. Palpation of the liver, spleen, both kidneys, gallbladder, common duct and large and small intestine failed to reveal any abnormalities. The patient made an uneventful recovery and was discharged on the eleventh postoperative day.

Pathologic report was as follows: The specimen consisted of a recognizable distal segment of stomach excised through the duodenum just below the pyloric sphincter. The serosal surface was smooth and an ovoid, somewhat resilient, freely movable mass was palpable in the antral region on the lesser curvature, measuring 3.1 cm. in maximum diameter. On gross section this tumor mass was found to be well circumscribed and protruding into the lumen 1.9 cm. The mass was covered by nor-

FIG. 1. Case 1. Intramural tumor producing filling defect in antrum with ulcer crater.

mal-appearing gastric mucosa which was freely movable. However, in the center of the mass (Fig. 2) the mucosa was ulcerated; this was 1.0 cm. in maximum diameter and 0.8 cm. in depth. On cut section (Fig. 3) the mass was confined to the submucosa and the cut surfaces were bulging, pale yellow, glistening and soft. The gastric mucosa otherwise and duodenal cuff showed no gross abnormalities.

Microscopic examination of many sections of the tumor showed it to be made up of innumerable mature adipose cells (Fig. 4) in close proximity. There were scattered thin and thick fibrous strands, and within these there were many thin-walled blood vessels. The tumor did not invade the mucosa or muscularis. The sections of the ulcer, which was immediately overlying the lipoma, showed on the luminal aspect characteristic zones of peptic ulceration with an inner layer of exudation. Underlying this there was some necrotic debris, and deep to this was granulation tissue which was heavily infiltrated with eosinophils, neutrophils and macrophages. This granulation tissue was immediately overlying the lipoma and extended into it in some areas The sections taken through other areas of the stomach showed an irregular decrease in the number of glands and a rather heavy lymphocytic infiltration with formation of lymph follicles; some of these follicles had large active germinal centers. There was no evidence of malignancy in any of the sections. Pathologic diagnoses: Lipoma, submucosa of stomach; gastric ulcer (overlying lipoma); chronic atrophic gastritis.

CASE II. An eighty-four year old white woman was admitted to the Morristown Memorial Hospital on November 11, 1953, with the chief complaint of tarry stools and vomiting of "coffee grounds" material. She had been in reasonably good health until about two months prior to admission when she began to complain of pain in the upper abdomen; the pain was worse at night and radiated through to the back. Milk, food and alkalis did not offer relief. The pain gradually became worse and appetite failed. The patient lost an unknown amount of weight. Two days prior to admission she passed tarry stools in copious amounts and vomited "coffee grounds" material. On the day of admission she again passed a tarry stool.

The patient had been taking digitoxin 0.2 mg. once a day for the past three years and also sodium nitrate for hypertension. Blood pressure averaged 190/100. Two months before the present admission her ankles had become edematous and she had been given a mercurial diuretic by mouth, with some improvement in the edema. A tumor of the thigh had been excised thirty years before and was said to have been benign.

Physical examination revealed an elderly, seriously ill white woman who did not appear cyanotic. Her pulse rate was 100 per minute and regular, and respiratory rate 30 per minute. Blood pressure was 140/70 and the temperature was 97.5°F. The mouth and tongue were very dry and coated with brown material. The heart was enlarged to the left and right. There was regular sinus rhythm at 100; sounds were of fair quality and no murmurs were heard. The left lung was clear to percussion and auscultation, and the right lung showed some moist rales at the base. The abdomen was slightly distended and tense throughout. Tenderness was noted and seemed most pronounced in the left lower quadrant. Coughing caused abdominal pain. Epigastric tenderness was also noted. A small, easily reducible left direct inguinal hernia was found.

Laboratory studies revealed a hemoglobin of 12.4 gm. per cent, leukocyte count 9,700 per cu. mm., polymorphonuclear leukocytes 68 per cent, lymphocytes 31 per cent and monocytes 1 per cent. Urinalysis revealed an alkaline reaction and 2 plus albumin. X-ray examination of the abdomen at the bedside showed no evidence of free air under either leaf of the diaphragm. No aneurysm of the abdominal aorta was seen. The patient was placed in an oxygen tent and given 1,700 ml. of whole blood and 2,000 ml. of 5 per cent glucose solution

FIG. 2. Case 1. Gross photograph (close-up) of the ovoid tumor in the lesser curvature of the stomach showing overlying ulcer.

FIG. 3. Case 1. Cut surfaces of the tumor.

in water. Digitalis and methoxyoximercuripropylsuccinylurea (mercuhydrin®) were also given. Four hundred milliliters of dark red blood were evacuated from the stomach through a Levin tube. It was the opinion of the attending surgeon that because of the patient's cardiac status, poor general condition and age, operative intervention was not indicated. Hence the supportive measures named heretofore constituted the entire treatment. She gradually became weaker, appeared to go into shock and died eleven hours after admission.

Autopsy was performed eight hours after the patient's death. The body was that of a well developed and well hydrated elderly white woman. In the middle, left anterior abdominal wall there was a movable soft mass 6 cm. in diameter. Dependent edema of the thighs, calves and back was present bilaterally. In the right pelvis a soft, smooth-surfaced cyst, thin walled and 12 cm. in diameter, was present within the folds of the right broad ligament. The heart weighed 620 gm. and showed much atheromatous plaque formation in the coronary arteries, and the pericardial sac contained 300 ml. of slightly cloudy amber fluid. The lungs showed some dependent vascular congestion.

The esophagus was normal. The stomach was of normal size and contained approximately 200 ml. of thick, dark red-brown liquid material. On the anteroinferior aspect near the greater curvature there was a flat ovoid tumor 5.5 cm. in maximum diameter and 1.0 cm. in thickness. The mucosa overlying this was ulcerated and the intact adjacent mucosa was movable. The ulcer measured 3.0 cm. in diameter and 0.5 cm. in depth. Two smaller ulcerations were also seen in the mucous membrane overlying the tumor mass 1.0 and 0.5 cm. in diameter. The tumor was in the submucosa and soft, pale yellow and freely movable.

Scattered diverticula were encountered in the rectosigmoid colon. Liver, spleen and pancreas were normal. The microscopic sections of the tumor of stomach showed mature adipose cells in close proximity, and among these were many small, thin-walled blood vessels and infrequent thin fibrous septa. On the outer aspect of this lipoma there was thinned muscle from the true muscular layer, and on the inner aspect the thin muscularis mucosae was seen. The lipoma appeared circumscribed by very thin fibrous tissue. The luminal aspect showed ulceration of the mucosa, and here all definite mucosal elements were missing and replaced by a variable amount of necrotic debris

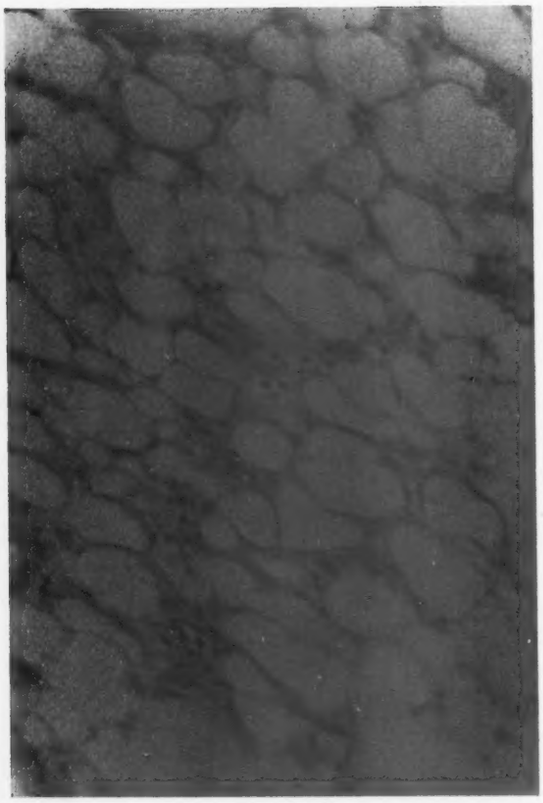

FIG. 4. Case 1. Tumor composed of innumerable mature adipose cells. Hematoxylin and eosin, × 200.

in which there were numerous inflammatory cells. Centrally in the ulcer there was abundant, fresh hemorrhagic material. The sections taken in other areas of the gastric mucosa showed mild chronic atrophic gastritis. This lipoma of the stomach with overlying ulceration apparently had its origin in the submucosa. It showed no evidence of malignancy. The kidneys revealed moderate arteriosclerotic scarring. The adrenals showed focal necrosis of cortex and apparent functional depletion. Leiomyoma of the uterus, non-neoplastic cyst of the broad ligament and lipoma of the skin of the abdomen were also found.

COMMENTS

In our experience lipoma of the stomach is rare. It has been found once in the 184 surgically resected stomachs examined and once in the 1,614 autopsies on file in this laboratory. It is not necessarily true that because a condition is rare it is clinically unimportant. Contrary to statements in current textbooks of surgical pathology, we are of the opinion that this lesion is not unimportant. It is clinically important for two reasons: (1) It can be responsible for serious symptoms, e.g., hemorrhage, pain and pyloric obstruction; and (2) it is surgically curable. In our cases the symptoms were the result of ulceration of the overlying mucosa; apparently this is the usual mechanism of symptom production. In one of our cases the lipoma caused death, and in the other it caused serious gastric hemorrhage. It is interesting to note that our Case 1 is similar to the case reported by Agey and Ponka [3] in that the admission clinical diagnosis was myocardial infarction. The entire picture, clinical course and treatment are very similar in the two cases.

In the large series collected from the literature by Palmer [*12*], 47 per cent of the patients had manifestations of hemorrhage, 27 per cent had abdominal pain and 20 per cent had obstructive symptoms. It is difficult to evaluate the presence or the absence of ulceration in the many cases reported but we believe that one can assume the presence of ulceration (or at least erosion) in the 47 per cent of patients who had hemorrhagic manifestations. Contrary to the sex predilection [*10*] of lipomas in other regions, 70 per cent in women, gastric lipomas occur with equal frequency in both sexes. Apparently these have not been seen during the first two and a half decades of life; the youngest patient described [*14*] in the literature was twenty-eight years of age and the oldest eighty-four, our Case 11. In each of our cases the lesion was located in the submucosa and in the antrum; this finding obtained in 94 and 69 per cent, respectively, of the cases reported. In our two patients the tumors were single, which was the finding in all but two of the cases in the literature. In these two reports [*11*] the lipomas were multiple and the diagnostic term "lipomatosis" was used. The size variation is interesting: the largest reported [*6*] lipoma weighed 1,300 gm. and the smallest was 0.8 cm. in maximum diameter [*15*].

SUMMARY

Two additional cases of gastric lipoma are reported. In both there was ulceration of the overlying mucous membrane. One patient underwent successful resection and the other had a fatal outcome following hemorrhage. We believe that gastric lipoma with overlying ulceration is clinically important and should be considered in the differential diagnosis in adult patients having gastric pain or bleeding.

REFERENCES

1. Ackerman, L. V. Surgical Pathology, p. 290. St. Louis, 1953. C. V. Mosby Co.
2. Anderson, W. A. D. Pathology, p. 823. St. Louis, 1948. C. V. Mosby Co.
3. Agey, W. L. and Ponka, J. L. Gastric lipoma with hemorrhage and myocardial ischemia simulating myocardial infarction. *Gastroenterology*, 28: 295–299, 1955.
4. Boyd, W. Pathology for the Surgeon, 17th ed., pp. 179–180. Philadelphia, 1955. W. B. Saunders Co.
5. Cassel, M. A. and Guccione, J. B. Submucous lipoma of stomach, case report and review of literature. *Arch. Path.*, 70: 598–601, 1955.
6. Didier, R. Tumeur bénigne de l'estomac. *Arch. d. mal. de l'app. digest.*, 27: 442–446, 1937.
7. Foot, N. C. Pathology in Surgery, p. 225. Philadelphia, 1945. J. B. Lippincott Co.
8. King, J. M. and Woelfel, G. F. Submucous lipoma of the stomach. *Am. J. Surg.*, 83: 32–34, 1952.
9. Moore, R. A. A Textbook of Pathology, 2nd ed., p. 658. Philadelphia, 1951. W. B. Saunders Co.
10. Mulligan, R. M. Syllabus of Human Neoplasms, p. 41. Philadelphia, 1951. Lea & Febiger.
11. Peabody, J. W., Jr. and Ziskind, J. Lipomatosis of the stomach. *Ann. Surg.*, 138: 784–790, 1953.
12. Palmer, E. D. Benign intramural tumors of the stomach, a review with special reference to gross pathology. *Medicine*, 30: 108–115, 1951.
13. Stout, A. P. Tumor of the stomach. A.F.I.P. Section VI, Fascicle 21–10, 1953.
14. Skorneck, A. B. Gastric lipoma. *Arch. Int. Med.* 89: 615–620, 1952.
15. Scott, O. B. and Brunschwig, A. Submucosal, lipoma of the stomach. *Arch. Surg.*, 52: 253–259, 1946.
16. Willis, R. A. Pathology of Tumors, 2nd ed., pp. 657–663. St. Louis, 1953. C. V. Mosby Co.
17. Weinberg, T. and Feldman, M. Lipomas of the gastrointestinal tract. *J. Clin. Path.*, 25: 272–281, 1955.

"Caspar Wistar, whose parents were of German extraction, was born in Philadelphia, September 13, 1761. . . . The Wistars were Quakers and Caspar as a boy went to Friends' School, founded by William Penn. It is said that young Wistar acquired a desire to study medicine during the battle of Germantown on October 4, 1777, at which he helped to care for the wounded. He became a private pupil of John Redman and worked with John Jones. At the same time he attended the lectures of Drs. Morgan, Shippen, Rush and Kuhn at the newly organized Medical School of Philadelphia. He attained the degree of Bachelor of Medicine (1782) and then went to England for a year. From there he went to Edinburgh and in 1786 received his degree of Doctor of Medicine. He returned to Philadelphia, where Dr. Jones was then the foremost surgeon. He took Wistar under his wing and the latter was appointed physician to the Philadelphia Dispensary, and in 1789 to the professorship of chemistry and physiology in the College of Philadelphia. He was physician to the Pennsylvania Hospital from 1793 to 1810. Also, he became a Fellow of the College of Physicians. Due greatly to Wistar's efforts the medical school connected with the University of Pennsylvania and the College of Philadelphia were united. After the consolidation he was associated with William Shippen as Adjunct Professor of Anatomy, Midwifery and Surgery in the University of Pennsylvania. Later surgery and midwifery became separate departments. After Shippen's death (1808) Wistar was made Professor of Anatomy. . . . He published a 'System of Anatomy' designed to be a textbook for his classes. It was a good work. He published several memoirs in the *Transactions of the American Philosophical Society*. He made a notable contribution to the anatomy of the ethmoid bone . . . Wistar played an active part in the cultured society of Philadelphia. 'His house was the weekly resort of the literati of the city of Philadelphia.' In 1813 he was the successor of Benjamin Rush as president of the Society for the Abolition of Slavery. In 1816 he became president of the American Philosophical Society. Caspar Wistar died in Philadelphia on January 22, 1818." (T. S. W., *Am. J. Surg.*, 17: 120, 1932.)

Repair of Through and Through Laceration of Superior Vena Cava, with Survival

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INJURIES to the great vessels entering and leaving the root of the heart have generally been fatal. This is due to the enormous blood loss which occurs within seconds and is not checked or even slowed by surrounding structures, but continues unimpeded into the chest cavity until exsanguination and death ensue. Only two cases have been found in the literature in which an injury to the superior vena cava was repaired surgically with survival of the patient.

In 1952 Hudson [1] reported the case of a gunshot wound in a forty-three year old woman. The bullet entered above the first rib close to the sternum, causing a rent in the superior vena cava just above the entrance of the azygos vein. This patient survived under conservative treatment for over eighteen hours. After this time lapse surgery was performed and, on thoracotomy, the previously described lesion was found to be "closed by clots and only minimal bleeding was taking place." The lesion was closed with No. 5-0 silk sutures. A factor which probably contributed significantly to the survival of this patient was the rapid bleeding and filling of the chest with blood, which created an equilibrium of pressure between the chest and the vena cava, thus permitting clot formation.

In 1933 Bigger [2] reported what appears to be the first case of survival of a stab wound of the superior vena cava.

This patient, a thirty-four year old man, was hospitalized thirty minutes after having been stabbed through the third costal cartilage 1 cm. to the right of the sternum. On exploration, a 1 cm. wound of the intrapericardial portion of the superior vena cava was found partially covered by the right auricular appendage. There was pericardial tamponade and approximately 500 cc. of blood in the chest. The wound in the vena cava was closed with three silk mattress sutures. The patient left the hospital in good condition thirty-two days postoperatively.

Both authors emphasize the deadliness of wounds of the great vessels of the mediastinum, which is confirmed by the extreme rarity of survival (two reported cases). Injuries to the heart itself have actually a far better prognosis since the thickness of the heart muscle will seal the wound either completely or partially and since the escaping blood is frequently trapped in the surrounding pericardial space causing pericardial tamponade. While pericardial tamponade will frequently prevent death from immediate exsanguination, the increasing amount of blood accumulating in the pericardial sac will compress the heart from all sides, reduce heart action mechanically and eventually choke the heart to a complete standstill. However, this process may take time (from fifteen minutes to two hours) and, if some blood leaks from the pericardial sac, thus relieving the cardiac compression, the patient may remain alive for as long as ten to twelve hours. For these patients surgical repair (pericardiotomy and cardiorrhaphy), instituted as promptly as circumstances permit, is the preferred treatment. Recent reports of an increasing survival rate [3] attest to the feasibility of operative intervention. In my own series of eighteen cases of repair of heart injuries, sixteen patients survived (89 per cent) [4].

The following case seems unique, since it represents a *double* laceration of the superior vena cava with survival.

CASE REPORT

M. C. (Hosp. No. 15679), a thirty-eight year old man, was admitted to the hospital on October

12, 1956. He had been stabbed with a butcher knife through the right second intercostal space 4 cm. from the sternal margin. (Fig. 1.)

He collapsed immediately and was brought to the hospital in an unconscious state, minutes after the injury. On arrival he was in deep shock, covered

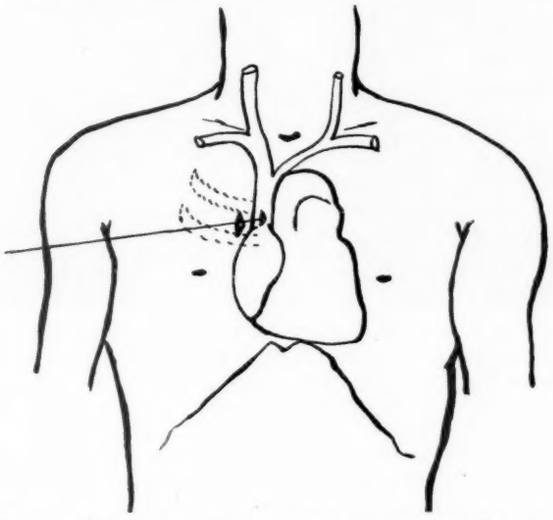

FIG. 1. Shows the situation of the stab wound in the second intercostal space and its relation to the laceration of the superior vena cava. Broken lines indicate the second and third rib.

with cold perspiration and had a grayish cyanotic color. The pulse was absent; blood pressure was 70/10 mm. Hg. The neck veins were markedly distended; the heart sounds were muffled, slow and barely perceptible. Venous pressure was 290 mm. instead of the normal 70 to 90.

The correct diagnosis of injury to the heart or great vessels was made on these clinical findings alone and the patient was taken to the operating room immediately. Plasma was given through venous cutdowns in all four extremities and replaced with blood as soon as it could be obtained. Oxygen was administered by mask. The operation was begun twenty-five minutes after the patient's arrival.

The chest was entered through a curved incision, skirting the upper margin of the sternum and extending along the third intercostal space. The second, third, fourth and fifth ribs were divided close to the sternal margin. The chest cavity was filled with blood and, while suction was applied, continued to be flooded with a steady stream of blood from the upper mediastinal region.

This region, containing the superior vena cava, was therefore compressed digitally and the sternum was transected quickly at the level of the second intercostal space in order to gain better exposure. The divided sternum was pulled apart with retractors.

The chest was then emptied of blood and the right lung allowed to collapse. A large hematoma was noted in the upper mediastinal region, obliterating all normal anatomical relationships. A steady and heavy stream of dark blood issued from the center of this hematoma. The pericardium

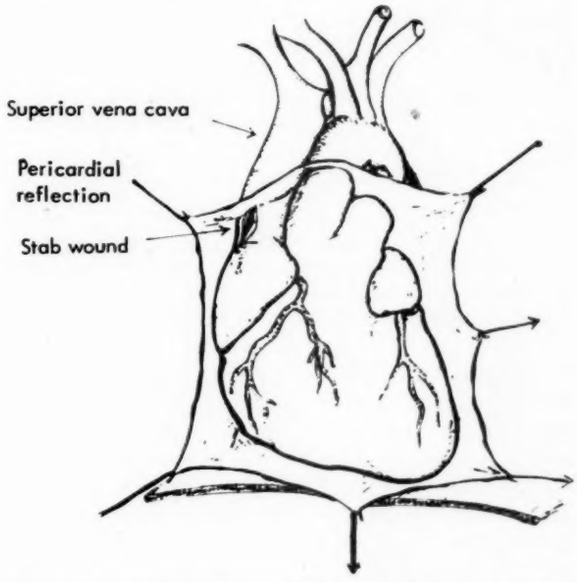

FIG. 2. Anterior stab wound in superior vena cava just inside of pericardial reflection.

was filled with dark blood and heart action was slow, ineffective and labored. It became apparent that either a large vessel at the root of the heart or the right auricle had been lacerated but proper control could not be accomplished without first opening the pericardium. After the chest had been cleared the pericardium was opened quickly from the apex upward. A torrential gushing of blood filled the operative field almost immediately and was controlled by blind compression of the structures of the upper mediastinum, using the thumb and fingers of the left hand. The field was then cleared of blood once more by suction and sponging, and again an attempt was made to visualize the injury. For an instant a 1.5 cm. laceration of the superior vena cava could be seen (Fig. 2) but immediately the field and chest were filled with blood again, making the proper placement of clamps impossible so that finger compression had to be applied again.

During this short time of one to two minutes, the patient had lost an estimated amount of 8 to 10 pints of blood. This was being replaced rapidly by transfusions under pressure in all four extremities. The patient had received a total of 4,000 cc. of blood and 1,000 cc. of plasma. However, at this point the supply of blood for transfusion was exhausted and further delay seemed unwise.

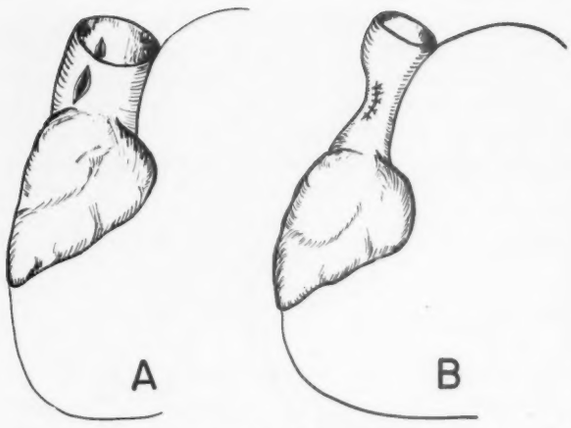

FIG. 3. A, location and relative size of anterior and posterior wounds of superior vena cava. B, appearance of superior vena cava after suture. The lumen is narrowed to approximately one-half of normal diameter.

Using the memory of the short visual exposure of the wound as well as the feeling of the compressing fingers as a guide, five silk sutures were placed blindly across the edges of the cut vein. This closed the wound correctly. However, when finger compression was released a severe hemorrhage occurred from behind the vein, and it became apparent that the knife point had passed through the vein making a .5 cm. laceration on its posterior aspect. (Fig. 3A.) This was clamped and closed with three additional No. 5-0 silk sutures, which were carefully placed to avoid further narrowing of the lumen of the vein. After this second laceration was closed, the lumen of the superior vena cava was about one-half of its normal diameter. (Fig. 3B.) A through and through laceration of the medial edge of the upper lobe of the lung was now repaired.

Our usual practice of leaving the pericardium open on the left side to prevent postoperative pericardial effusion was abandoned in this case because the violent dislocations of the heart toward the right side made it seem advisable to close the pericardium loosely, leaving a 2 cm. gap at the apex. The chest was closed in the usual manner.

At the end of the operation the patient's blood pressure was 120/70 mm. Hg, pulse 120, respiration 20.

On the fifth postoperative day the patient became restless, dyspneic and excited. His pulse rose to 118, his respiration to 40 and he appeared cyanotic. X-ray of the chest showed a mass in the right upper mediastinum and an enlarged cardiac shadow.

Pericardiocentesis was performed through the fourth left intercostal space and 300 cc. of serosanguineous fluid was removed with immediate improvement of the patient's clinical condition. This was repeated the following day and 100 cc. was removed. Cultures of this fluid were sterile.

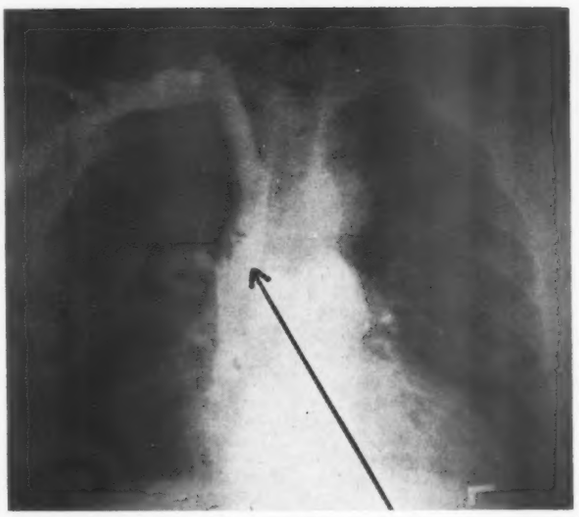

FIG. 4. Venogram taken twelve weeks postoperatively (0.5 seconds after injection of dye) shows two filling defects at terminal superior vena cava, apparently caused by scar formation.

The patient made a slow recovery. His venous pressure, which remained elevated to about 190 mm. at first, gradually came down to a near normal 100 to 110 mm. during the six to eight weeks after the operation.

In view of the fact that the diameter of the superior vena cava was narrowed to one-half of normal by two separate suture lines, leaving a patent lumen of only one-quarter of normal, and since no precedent of similar cases could be found in the literature to be used as a guide, it was believed best to keep the patient in bed for a longer period of time than that usually employed in heart wounds.

The criteria of improvement were: (1) x-ray evidence of subsiding pericardial effusion and the return of the cardiac silhouette to normal size, shape and position; (2) return of pulse rate to normal; (3) return of venous pressure to normal.

The patient was allowed out of bed three months postoperatively. No ill effects were observed with gradual ambulation and he was discharged on February 7, 1957, with his wound well healed, a stable thorax and in good general condition.

Venograms taken at this time showed that the diameter of the superior vena cava apparently had dilated again to normal size, a fact which is consistent with the normal venous pressures. Two linear filling defects are clearly visible at the point of entrance of the superior vena cava into the right auricle, apparently caused by scars. (Fig. 4.)

COMMENTS

This appears to be the first survival of a patient with a through and through stab wound of the superior vena cava.

The following factors must be considered responsible for this gratifying result: (1) immediate diagnosis made from clinical observation alone; (2) immediate surgical intervention, eliminating the loss of time which is usually caused by diagnostic procedures; (3) massive and rapid blood replacement under pressure from four portals; and (4) wide surgical exposure and the willingness to deviate from accepted technical steps (blind closure by touch only) in the face of an overwhelming emergency.

REFERENCES

1. Hudson, T. R. Wound of the superior vena cava with survival. *J. Thoracic Surg.*, 24: 101–104, 1952.
2. Bigger, I. A. Wound of the superior vena cava treated by suture. *Arch. Surg.*, 27: 392–394, 1933.
3. Maynard, A. de L., Avecilla, M. J. and Naclerio, E. A. The management of wounds of the heart. A recent series of 43 cases with comment on pericardicentesis in hemopericardium. *Ann. Surg.*, 144: 1018–1022, 1956.
4. Elkan, W. Heart wounds, personal experiences. *Harlem Hosp. Bull.*, 9: 49–61, 1956.

"Nathan Smith was born in Rehoboth, Mass., September 30, 1762. He was 'one of the great pioneers of American medicine, and during his active life was the omnipresent genius in New England medicine.' He taught in the local rural school. During this time Dr. Josiah Goodhue of Vermont visited the neighborhood to amputate a leg and Nathan acted as a lay assistant. This awoke a desire to study medicine. The Reverend Whiting of Rockingham, Vt., became his tutor. In 1784 he presented himself to Dr. Goodhue as a private student and remained three years. At the age of twenty-five he began to practice (1787) in Cornish, N. H., without a medical degree. He attended several courses of lectures at the Harvard Medical School and received his degree of Bachelor of Medicine (1790), the fifth student to graduate from the Medical School in the third class of that school. His M.D. was conferred on him automatically in 1811. . . . While practicing in Cornish he was impressed with the meager facilities for medical education. In 1796 he attempted to start a medical school at Dartmouth College, but failed. Smith then went abroad and studied in Edinburgh and London. Soon after his return in 1797 he was awarded a diploma from the Medical Society of London. He also became a corresponding member. In the Fall of 1797 he delivered the first course of medical lectures at Dartmouth. In August, 1797, the trustees established a medical department with Smith as professor of anatomy, surgery, chemistry and physics. Oliver Wendell Holmes said it was not a chair but 'a whole settee of professorships.' Thus the fourth medical college in the United States was founded. In 1821 he was asked to establish a medical department at Yale. He accomplished this in the face of many obstacles. He did the same for Bowdoin College (1820) and later for the University of Vermont. He was never a voluminous writer, although his essay on typhus fever (1824) and his observations on necrosis (1827) are still memorable. He operated for amputation of the knee joint, performed the second ovariotomy in the United States, and did the first staphylorrhaphy. But he will be known as a great teacher and organizer. He died at the age of sixty-seven years in 1829." (T. S. W., *Am. J. Surg.*, 16: 539, 1932.)

Lipoma of the Spinal Cord Simulating Degenerative Disease

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IT is now well known that tumors of the spinal cord in the cervical region may simulate non-surgical spinal cord disease such as multiple sclerosis and amyotrophic lateral sclerosis. From time to time, patients who have been condemned with a diagnosis of degenerative disease eventually are found to have tumors in the region of the foramen magnum or even lower in the cervical spinal cord.

The following case report is considered to be of interest not only because of the many years during which the patient was thought to have degenerative spinal cord disease but also because of the nature of the tumor, a benign lipoma, which at first appeared to be extramedullary but on further inspection was found to invade the spinal cord. Decompressive laminectomy with partial removal of the tumor was followed by an excellent result.

CASE REPORT

The patient, a fifty-nine year old white man, had been in good health until twelve years prior to his admission to the hospital. At that time he noted some weakness in the left hand. Shortly thereafter he noted a drawing pain in the entire left upper extremity. This was followed by numbness of the left hand. He would often burn his fingers while smoking without feeling pain. He then began to drop objects from his left hand and was unable to recognize small objects placed in his hand. In spite of the difficulty with his left upper extremity he was able to continue his work as a machinist until about ten years later when he injured his right little finger while at work. This was followed by a feeling of numbness in the fourth and fifth fingers of the right hand. At about this time he noted that when sitting down he had a sensation as if he were sitting on an air pillow. When walking, he had a peculiar sensation as if standing on cushions. He was unable to tell the difference between walking on a solid floor or on a rug. Two years before his hospital admission he began to have greater difficulty in walking. He also complained of low back pain and had trouble bending over to tie his shoes. He would often lose his shoe and not know that he had lost it until he looked down at his feet. For several weeks just prior to his entrance to the hospital he had many falls because of a marked gait defect.

Examination revealed he had great difficulty in walking. Gait was accomplished with slow small steps with loss of associated movements. The reflexes in the upper extremities were greatly diminished or absent while those in the lower extremities were markedly increased. The abdominal reflexes were absent. There was no Babinski sign. Atrophy of the left shoulder girdle and of the left hand was present, and there was generalized reduction in motor power in the entire left upper extremity. Sensation for light touch was moderately diminished below the fifth cervical segments on both sides. Position sense was diminished in both hands and absent below the knees. Pain sensation was markedly diminished in both upper extremities, as was temperature sensation. Lumbar puncture disclosed a clear, colorless fluid. There was no evidence of a block. Total protein in the spinal fluid was 55 mg. per cent. Plain x-rays of the spine were considered to be within normal limits. There were no other significant laboratory findings. A myelogram was taken by injecting 9 cc. of pantopaque® into the cisterna magna with the patient erect. Fluoroscopic examination disclosed a constant filling defect at the level of the middle of the body of the third cervical vertebra. The upper margin of the defect was rounded and convex upward. The pantopaque slowly ran past the obstruction into the lower portions of the spinal subarachnoid space. It was allowed to collect in the cul de sac. The patient was then positioned with his hips higher than his head and the pantopaque was permitted to flow into the cervical canal once more. The lower border of a filling defect was now delineated. The panto-

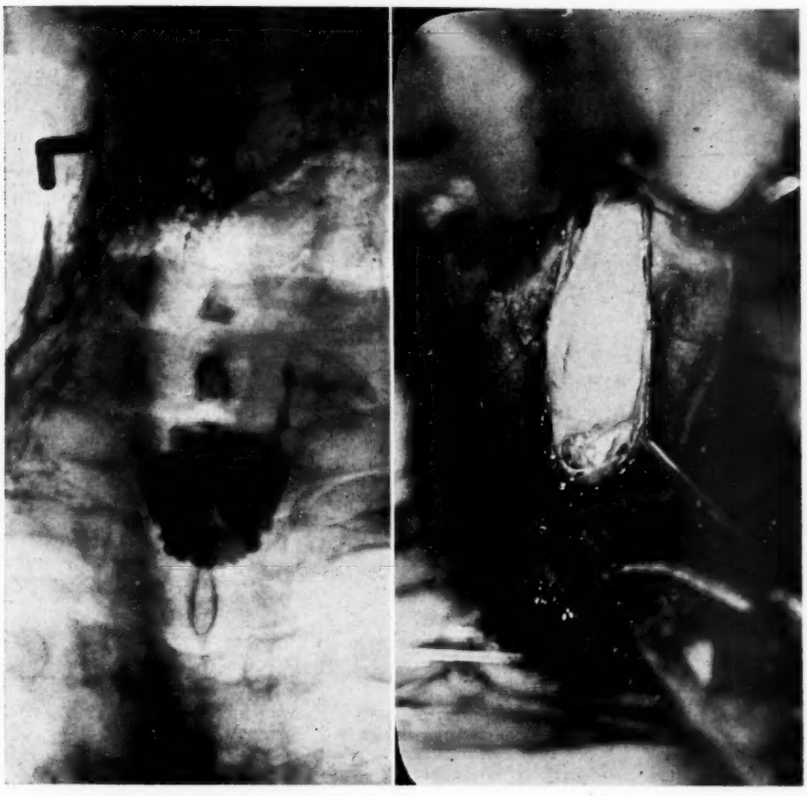

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FIG. 1. Myelogram showing cap at the lower pole of the tumor (T1).

FIG. 2. Photograph taken at operation showing tumor *in situ* after opening the dura.

paque outlined a definite cap at the level of the first thoracic vertebra. (Fig. 1.)

Laminectomy was performed with the removal of the spines and laminas of the third, fourth, fifth, sixth and seventh cervical vertebra as well as the spine and lamina of the first thoracic vertebra. The dura did not pulsate. On opening the dura an orange-yellow tumor about 7 cm long and 2.5 cm wide was found. (Fig. 2.) The tumor was below the arachnoid. On opening the arachnoid it was possible to free the upper and lower poles of the tumor which at first seemed to be extramedullary. Further inspection, however, showed that the ventral surface of the tumor was intimately connected to the spinal cord. The capsule of the tumor was split and an intracapsular removal was performed. The dura was left open for decompressive purposes.

The specimen consisted of five soft yellow fragments of fatty tissue. The largest measured 2 by 0.8 by 0.5 cm. The tissue had the typical "chicken wire" appearance of fatty tissue. A few of the blood vessels had unusually thick walls.

The patient had a smooth postoperative course and he was discharged twenty-five days later.

Following several months of recuperation the patient returned to his work as a machinist. He worked for about one year when he found it increasingly difficult to hold a position because he was unable to work at a speed equal to that of other machinists on similar jobs. He then opened up a small "fix-it" shop and has been able to continue at this. When last examined, almost six years after laminectomy, he was able to walk; however, he used a cane to steady himself. He was free of pain. On examination, movements of the cervical spine were free and without pain. There was marked weakness and atrophy in the small muscles of the left hand and less marked atrophy in the small muscles of the right hand. Sensation for light touch and pinprick was markedly impaired in the sixth, seventh and eighth cervical dermatomes as well as in the first thoracic dermatome on the left. On the right side sensation was impaired in C8 and T1. Position sense in the toes of both feet was preserved. The Babinski sign was not present

COMMENTS

Among the excellent reviews concerning intraspinal lipomas, that of Krainer [*1*] is per-

haps the most informative. Ehni and Love [2] reported seven cases of intraspinal lipomas from the Mayo Clinic in a review in which they provide an extensive bibliography and a tabulation of the previously reported cases. Since then additional cases have been reported by Johnson [3], Crosby, Wagner and Nichols [4], Taniguchi and Muffson [5], as well as by Lima-Costa [6]. Ehni and Love concluded that nearly 1 per cent of intraspinal tumors are lipomas. This corresponds fairly closely with the statistical studies of Wolf [7] who found four lipomas among 254 intraspinal neoplasms which he studied. Most lipomas are composed of adult fat cells. Grossly, at the operating table, intradural lipomas have been described by several authors as having a deep yellow or orange color, in contrast to the pale yellow of normal fat. This was true of the case reported herein. Lipomas may be entirely extradural or entirely intradural, both extramedullary and intramedullary. There have been cases, however, in which the lipoma was both extradural, intradural and intramedullary.

In a boy of ten who had the onset of a spinal deformity at the age of one and gait disturbances at the age of six, I found a lipoma which began at the twelfth dorsal vertebra and involved the entire spinal canal distal to that point. The tumor was extradural at the twelfth thoracic level. It became intradural at the first lumbar level and below the first lumbar level it was intimately connected with the conus and the cauda equina.

Ehni and Love [2] concluded that intradural lipomas are invariably separated from the nerve tissue by a layer of fibrous tissue of pial derivation. The pial capsule, however, very often sends heavy extensions into the cord so that the tumor appears invasive. They did not consider this feature of the intradural lipomas to be an expression of malignancy. They believed that extradural lipomas were related in some way to a vague defect of the primitive fat-forming tissue itself.

SUMMARY

The case reported herein is unusual because of the very long period during which symptoms of spinal cord disease developed. It has been known for many years that tumors in the cervical region may reach a large size and yet not cause any alteration in spinal manometrics or in the spinal fluid protein. The wisdom of performing myelography in patients presumed to have degenerative spinal cord disease without evidence of dissemination is reaffirmed.

REFERENCES

1. Krainer, L. Die Hirn- und Ruckenmarkslipome. *Virchows Arch. path. Anat.*, 295: 107–142, 1935.
2. Ehni, G. and Love, J. G. Intraspinal lipomas. *Arch. Neurol. & Psychiat.*, 53: 1–28, 1945.
3. Johnson, D. F. Intramedullary lipoma of the spinal cord. *Bull. Los Angeles Neurol. Soc.*, 15: 37–42, 1950.
4. Crosby, R. M. N., Wagner, J. A. and Nichols, P. Intradural lipoma of the spinal cord. *J. Neurosurg.*, 10: 81–86, 1953.
5. Taniguchi, T. and Muffson, J. A. Intradural lipoma of the spinal cord. *J. Neurosurg.*, 7: 584–586, 1950.
6. Lima-Costa, A. Lipomas sub-durais primitovos do canal raquiano. *J. brasil. neurol.*, 6: 1–119, 1954.
7. Wolf, A. Chapter in: Surgical Diseases of the Spinal Cord, Membranes, and Nerve Roots, by Elsberg, C. New York, 1941. Paul B. Hoeber.

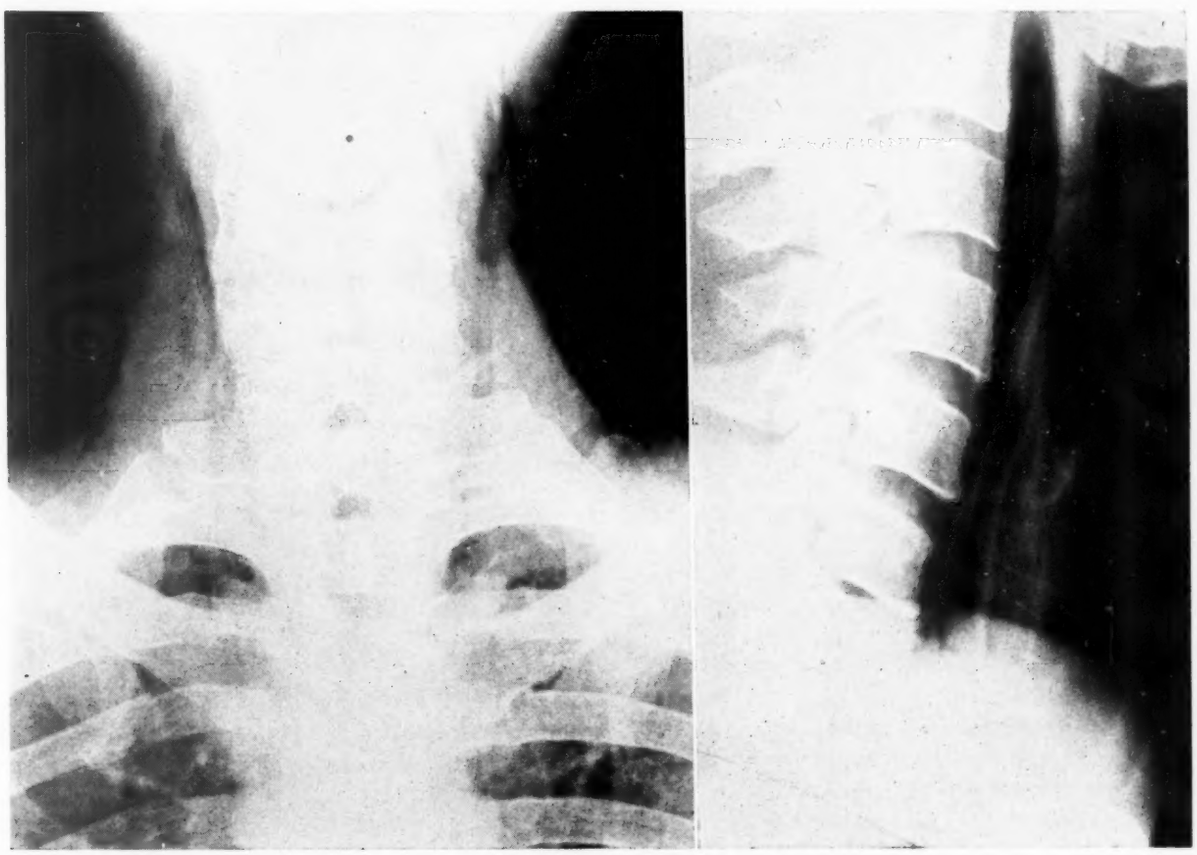
The Diagnostic Corner

A CLINICAL and radiological teaching exercise concerning an interesting surgical emergency

SIDNEY W. NELSON, M.D., *Columbus, Ohio*

From the Department of Radiology, The Ohio State University, Columbus, Ohio.

THIS thirty-eight year old Negro man was admitted to the Ohio State University Hospital for the first time on July 5, 1955, with a history of a sudden onset of severe epigastric and retrosternal pain following an episode of vomiting eight hours previously. The patient admitted a massive alcoholic intake for approximately forty-eight hours prior to the



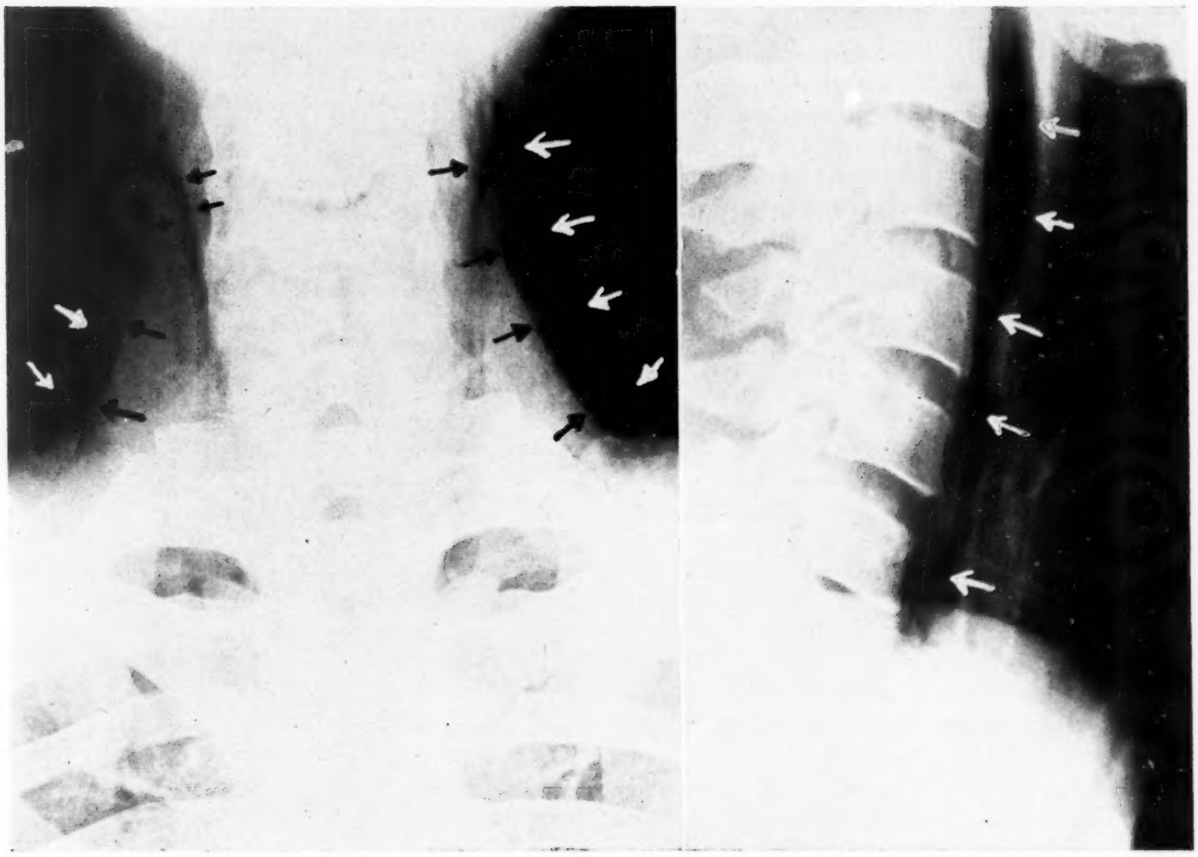
Frontal and lateral films of cervical region (discussed in text).

sudden onset of his illness. Physical examination at the time of admission showed a well nourished, well developed middle-aged Negro man in obvious acute distress because of constant severe epigastric and retrosternal pain. There was a pleural friction rub in the left posterolateral chest. There was marked abdominal guarding, particularly in the epigastrium, but there was no rebound tenderness and peristaltic bowel sounds were normal. The white blood count was 24,000 per cu. mm., with 86 per cent neutrophils. On the basis of these findings it was believed that the patient had a perforated or penetrating duodenal ulcer. He was sent to the radiology department where supine and erect films of the abdomen showed no evidence of free air beneath either leaf of the diaphragm, and no other evidence of intra-abdominal abnormality. An x-ray film of the chest showed interstitial emphysema in the cervical region. The interstitial emphysema is well demonstrated on the foregoing frontal and lateral films of the cervical region. The interstitial emphysema in a patient with the aforementioned history and physical findings should suggest a specific diagnosis of a condition demanding immediate surgery.

What is your diagnosis?

Please see opposite page

DIAGNOSIS: Spontaneous perforation of lower esophagus.



The acute onset of severe epigastric and retrosternal pain following an episode of vomiting after a two-day alcoholic debauch is, in itself, not typical for any specific lesion. However, the absence of rebound tenderness or other abnormal abdominal findings in a patient with severe retrosternal pain should suggest the possibility of a supradiaphragmatic lesion such as myocardial infarction or spontaneous rupture of the esophagus. Furthermore, the occurrence of cervical emphysema a few hours after the sudden onset of severe epigastric and substernal pain is almost pathognomonic of a perforated esophagus.

A presumptive diagnosis of a perforated esophagus can be verified by having the patient ingest radiopaque water-soluble contrast material, which can usually be seen to extravasate outside the lumen of the esophagus into the periesophageal tissues, as was true in this patient. Surgery should be carried out without delay in order to reduce the high mortality in this lesion. The patient discussed here was immediately taken to surgery where two perforations were repaired in an otherwise normal lower esophagus. The mediastinal acute inflammatory reaction had involved the posteromedial parietal pleura, which accounted for the pleural friction rub heard in the posterior left chest on admission. The patient had an uneventful recovery and has remained completely well since surgery. Postoperative radiographic examinations of the esophagus have shown a normal organ.

The radiologist was of great help to his clinical colleagues in this particular case, having first suggested the diagnosis on the basis of history and cervical interstitial emphysema, and then proceeding to confirm the diagnosis with water-soluble contrast material. This case is also of interest because it illustrates the value of a regular x-ray film of the chest in the study of a patient with what appears to be an acute condition within the abdomen. An

x-ray film of the chest is an integral part of the radiologic study of the acute condition within the abdomen in our institution.

Acknowledgment: This case has been previously reported in *The American Journal of Roentgenology, Radium Therapy and Nuclear Medicine* (CHRISTOFORIDIS, A. and NELSON, S. W. Spontaneous rupture of esophagus; with emphasis on the roentgenologic diagnosis. Volume 68, number 4, pages 574–580, October, 1957).

REFERENCES

1. BARRETT, N. R. Spontaneous perforation of esophagus; review of literature and report of three new cases. *Thorax*, 1: 48–70, 1946.
2. BRACHNEY, E. L., CAMPBELL, G. S., THAL, A. P. and WANGENSTEEN, O. H. Spontaneous perforation of esophagus; experimental study. *Proc. Soc. Exper. Biol. & Med.*, 88: 307–310, 1955.
3. PRIVITERI, C. A. and GAY, B. B., JR. Spontaneous rupture of esophagus. *Radiology*, 57: 48–57, 1951.
4. WARE, G. W., SHNIDER, B. I. and DAVIS, E. W. Spontaneous rupture of esophagus. *Arch. Surg.*, 65: 723–745, 1952.
5. STARKEY, G. W. B. Spontaneous rupture of esophagus; with presentation of four new cases. *J. Thoracic Surg.*, 30: 300–315, 1955.

Case Analysis Clinic

ROGER D. WILLIAMS, M.D., *Columbus, Ohio*

PATIENT B. Mc., a seventy-three year old white man, was admitted with the history of pruritus, a 40 pound weight loss and progressive severe icterus of two months' duration. Pruritus began just prior to his discharge from another hospital where he had uneventfully undergone bilateral cataract extractions. He had had no pain, nausea, vomiting or intolerance to fatty foods. There had been no previous abdominal surgery and no transfusions were given during his previous hospitalization for eye surgery. He did have several injections while in the hospital.

Physical Examination. Physical examination showed a somewhat emaciated, elderly, severely icteric man with blood pressure of 160/80 mm. Hg and otherwise normal vital signs. There were superficial excoriations of the skin but no spider angiomas. The liver was felt 3 cm. below the costal margin on inspiration; it was firm, smooth and non-tender. The spleen and gallbladder were not felt. The remainder of the physical examination was negative for abnormalities.

Laboratory Data. Upper gastrointestinal x-ray films showed a constant indentation along the medial aspect of the duodenum in the region of the ampulla without change in the mucosal pattern. This was interpreted as indicative of a pancreatic tumor.

The urine had an acid reaction (pH 5.4) and specific gravity of 1.015; otherwise it was normal. The hemoglobin was 10.8 gm. per cent, the red blood cell count 3.89 million per cu. mm. and the white blood cell count 7,000 per cu. mm. The blood urea nitrogen was 15 mg. per cent. Icterus index, 200; cephalin flocculation test, trace; thymol turbidity test, 20 units; alkaline phosphatase, 22.8 Bodansky units; prothrombin, 90 per cent. The total protein was 7.1 gm. per cent, albumin 3.9 gm. per cent and globulin 3.2 gm. per cent. The cholesterol was 150 mg. per cent, esters 21 per cent. Stool guaiac was negative; blood volume (radioactive iodinated albumin method), 1,400 cc. deficit.

Problems. Differential diagnosis, preoperative preparation, postoperative complication.

Differential diagnosis: The clear history of painless, progressive jaundice with severe pruritus and weight loss strongly suggested extrahepatic biliary obstruction. Although pain is common with malignancy, carcinoma of the pancreas is the most common cause of painless jaundice with significant weight loss. Absence of pain is rare with icterus due to common duct stone. There was no history of previous surgery or blood transfusions, and any injections given at another hospital two months earlier following the cataract surgery were considered given with needles adequately sterilized against hepatitis virus. The physical findings also corroborated to some degree obstructive jaundice, although the gallbladder was not felt. An enlarged, non-tender gallbladder is palpated, however, in only about one-third of patients with jaundice due to extrahepatic malignancy (positive Courvoisier's law). The liver was not greatly enlarged or tender; the icterus was a deep yellow-green and the patient was malnourished; splenomegaly and skin angiomas were absent. Therefore, both the history and physical findings weighed heavily for the diagnosis of surgical jaundice.

The laboratory results corroborated this initial impression of obstructive (surgical) jaundice. In the presence of progressive, severe icterus the alkaline phosphatase had remained elevated yet only minimal liver parenchymal injury had developed. The cephalin flocculation and thymol turbidity were normal. The cholesterol and cholesterol esters were low; however, the prothrombin remained normal.

In the face of these findings, interpretation of the upper intestinal x-ray studies led to a preoperative diagnosis of obstructive jaundice due to malignancy in the pancreas or bile ducts.

Preoperative preparation: A high protein, 3,000 calorie diet was encouraged, nearly three-fourths of which the patient was able to eat daily. Since both pancreatic and bile ducts were considered obstructed, pancreatic extract and bile salts were given to aid the absorption of oral food. Whole blood, 1,500 cc., was given to restore blood volume to normal. Vitamin K, 10 mg., and therapeutic multivitamins were given daily. The day before surgery tetracycline, 100 mg. every six hours, was begun to obtain preoperative blood and bile levels in order to prevent postsurgical cholangitis.

Surgery: Through a right paramedian incision carried high into the xiphocostal angle the liver was found to be only slightly enlarged. The gallbladder was thin-walled and contained only a few small stones. The common bile duct was of normal size. The gallbladder was removed and the common duct explored. No obstruction was noted either in the distal portion of the common duct or the hepatic ducts. In order to visualize the hepatic ducts further, as well as the common bile duct, an operative cholangiogram was performed. No intra- or extrahepatic obstruction was noted. In view of the absence of obstruction there was no hesitation in obtaining a biopsy specimen of the liver. Microscopically the liver showed marked biliary stasis with slight periductal round cell infiltration.

Postoperative complication: The biopsy of the liver suggested cholangitis. Careful questioning of the patient and a review of the medications given him two months earlier at another hospital showed that he had received chlorpromazine by injection, 100 mg. daily, for six days following his cataract surgery. This preoperative diagnosis had been considered but the patient was questioned only about oral medications. The pathological findings were compatible with chlorpromazine jaundice. The x-ray findings leave the radiologist with further explanations to give!

The patient tolerated the operative procedure well; however, shortly after being returned to his room from the recovery room his blood pressure, preoperatively recorded as 130/70 to 160/80 mm. Hg and holding above 120/70 during surgery, dropped to between 90/60 and 80/50. The mechanism of this blood pressure decline was unknown. Preoperative blood volume deficits were adequately replaced and 500 cc. of whole blood were given during surgery. The surgical loss was estimated as less than 350 cc. and there was no indication of further intra-abdominal hemorrhage. Retention of carbon dioxide may have been a factor since the patient had moderate emphysema; however, his respiratory exchange was considered good. With nasal oxygen therapy alone the blood pressure returned to 128/80 after four hours.

Short periods of hypotension may be of no significance in non-icteric patients; however, on the second postoperative day this patient was lethargic. The blood urea nitrogen had risen to 37 mg. per cent. Two days later the blood urea nitrogen was 43 mg. per cent. Uremic acidosis was suspected but serum electrolytes showed a sodium value of 148 mEq./L. and chloride value of 110 mEq./L., values which may be noted with dehydration alone. Only the blood CO_2 value of 34 volumes per cent (15.2 mEq.) showed the extent of the acidosis.

Uremic acidosis associated with a low blood CO_2 and high serum sodium and chloride had been noted in similar cases with poor renal function following hypotension in jaundice and required careful fluid and electrolyte management. Even when urine output is low, there is usually a failure of urine concentration to above 1.012. An attempt to determine the kidneys' ability to concentrate is unnecessary and contraindicated. A high urine output must be maintained, saline withheld and the acidosis corrected with sodium bicarbonate or sodium lactate. In this patient fluid therapy (5 per cent dextrose in water intravenously, plus oral intake) was increased to produce a urinary output which ranged between 1,075 and 1,950 cc. daily. Small amounts (68 mEq.) of $NaHCO_3$ were given daily for three days. Blood electrolyte values remained normal and the blood urea nitrogen dropped to 19 mg. per cent by the twelfth postoperative day. A significant complication was forestalled and the patient made a progressive recovery, his icterus index having dropping to 100 three weeks following surgery.

SUMMARY

This case of apparent obstructive jaundice illustrates three important factors in the surgical management of the jaundiced patient.

1. Despite numerous laboratory determinations, a careful history remains the most important factor in the differential diagnosis of

jaundice. Certain medications in widespread use (chlorpromazine, testosterone) can produce jaundice with laboratory results suggesting surgical obstruction and these medications are given by hypodermic injection as well as orally.

2. A careful preoperative preparation should include attempts to maintain if not restore nutritional deficits by the oral route and the prevention of postoperative infection of the biliary tract by antibiotics which are excreted in the bile. Oral feedings require bile and often pancreatic extract supplements to aid absorption as well as the regularly prescribed vitamins A, B, C, K. Blood volume deficits will be large and require adequate replacement.

3. Hypotensive episodes, minimized by adequate blood volume replacement before and during surgery, are of serious consequence. The resulting renal tubular damage leads to failure of urine concentration and dangerous electrolyte imbalance, usually a uremic acidosis. The often found elevations of serum sodium and chloride are due in part to dehydration and do not contraindicate the giving of further sodium to correct the acidosis. When this complication develops, the output of urine must be increased, usually to 1,500 cc. or more daily; saline should be withheld and sodium lactate or bicarbonate given.

REFERENCES

1. Zollinger, R. M. and Williams, R. D. Surgical aspects of jaundice. *Surgery*, 39: 1016, 1956.
2. Werther, J. L. and Korelitz, B. I. Chlorpromazine jaundice, an analysis of twenty-two cases. *Am. J. Med.*, 22: 351, 1957.
3. Williams, R. D. and Zollinger, R. M. Principles of surgical nutrition. *Am. J. Clin. Nutrition*, 3: 449, 1955.

Surgery Court Cases

HOWARD NEWCOMB MORSE,* *Chicago, Illinois*

STEWART VS. RUDNER

349 Mich. 459, 84 N. W. 2d 816

This action was taken by a woman whose child was stillborn, against one surgeon for failure to perform a cesarean section as agreed and for damages resulting from an allegedly unauthorized operation (episiotomy) performed by another surgeon, and against both surgeons for assault and battery. The Circuit Court of Genesee County, Michigan, dismissed the action for the operation performed and for assault and battery, and rendered judgment in favor of the plaintiff for the failure to perform the cesarean section, and the surgeon appealed. The Supreme Court of Michigan affirmed the decision of the lower court.

The evidence sustained the finding that the baby would have lived had the cesarean section been performed as agreed. The Court declared: "First of all, the jury was justified in finding that the baby was alive, with a strong fetal heart beat, on the morning of September 4th, when plaintiff and her husband came to defendant's office, expressing concern that delivery 'was not made at the regular period.' The jury also knew that the mother's full term had run, that the long wait was over and the hour of delivery at hand. The jury knew, in addition, that plaintiff's pains had commenced, that they persisted and that within hours, in fact, she was admitted to the hospital and delivered of a dead child. They would be justified in finding, on these facts, that if plaintiff had been sent to surgery, instead of back home, on the morning of September 4th (at the latest) that her baby would have been delivered alive."

The Court held that the plaintiff was entitled to recover for pain and suffering as well as loss of wages directly resulting from the surgeon's failure to perform his contractual duty. The Court stated: "The damages claimed are for pain and mental suffering, and for loss of wages (for a 13-week period following her recovery from the physical results of the episiotomy performed) due to her nervous condition and chills, and fever attendant upon and arising from the circumstances . . . The jury was justified in finding that these resulted directly from defendant's failure to perform his contractual obligations."

RULE VS. CHEESEMAN

Supreme Court of Kansas
181 Kan. 957, 317 P. 2d 472

This was a malpractice action for $20,000 damages by a patient against the estate of a deceased surgeon, who had allegedly permitted a gauze pad or surgical sponge to remain in the patient's body after an operation for gallstones. The District Court of Johnson County entered an order sustaining a motion of the executrix of the estate for a directed verdict, and the patient appealed. The Supreme Court of Kansas reversed the judgment of the lower court and remanded the case to the *nisi prius* court with instructions that a new trial be granted.

The Supreme Court of Kansas held that the leaving of a sponge in a wound after an incision has been closed constitutes *prima facie* negligence on the part of the operating surgeon and has the legal effect of casting upon the surgeon the *onus probandi* (the burden of proof) of showing his freedom from negligence. The Court declared that: ". . . an operation requiring the placing of sponges in the incision is not complete until the sponges are properly removed . . . the leaving of sponges or other foreign substances in the wound after the incision has been closed is at least *prima facie* negligence by the operating surgeon . . . al-

* Counsellor at Law, Member of the Bar of the Supreme Court of the United States of America.

though there are many cases which take the view that such a failure on the part of the surgeon is negligence *per se** . . . the treatment may so plainly indicate that the physician has been negligent as to shift to him the burden of showing, '. . . that the act [of] *prima facie* negligence was not so in fact; for example, the burden of showing care is on a surgeon who leaves a sponge inclosed in a wound after the performance of an operation'."

The Court ruled that inasmuch as the surgeon held himself out to the public as a *specialist* in surgery he, *as a matter of fact*, had a common law duty to bring the skill and care of such a *specialist* to the plaintiff as his patient. The Court further ruled that it was impossible for it to hold under the record in the case *as a matter of law* that the surgeon used such degree of skill and care in his treatment of the plaintiff as his patient.

The Court also held that a sponge count by a nurse before and after an operation is not determinative. "That the nurses kept the sponge count," the Court stated, "seems to avail him [the surgeon] little, if anything, because the sponge was found at the point of the operation and there was nothing in the record to dispute this fact. It remains a question of fact for the jury to decide. In other words, a count of sponges by a nurse before and after an operation is not conclusive."

The Court concluded that the plaintiff had the right to have the surgeon's acts submitted to the jury for its determination as to whether his acts constituted negligence and were the proximate cause of the plaintiff's injury or resulting damage, and that the failure of the lower court to make such submission to the jury necessitated a new trial.

* An act which so strongly suggests negligence as to be held by a court as a matter of law to constitute negligence.

Book Reviews

The Diagnosis and Treatment of Infections. By D. Geraint James, M.A., M.D. 224 pages, 24 tables, 1 figure. Charles C Thomas, Publisher. Springfield, Ill., 1957. *Price* $6.00.

This book is written in three parts with an attempt to outline very briefly nearly all infections, giving the diagnosis and antibiotic treatment. The first section gives the initial isolation antimicrobial range, indications for use, forms and dosage of various antibiotics. The last chapter of this section giving the complications of these drugs is somewhat incomplete but the remainder of this section is very good.

Section II lists, in an orderly manner, organisms, the diagnosis of the disease process each causes, prevention and treatment. Treatment in several instances is far from complete, even in outline form, and in a few instances differs somewhat from accepted therapy in the United States. Although there may be sporadic disagreements with antibiotic dosage as given by the author, these differences will generally be of little significance.

Section III presents infections involving various organ systems. The tables, twenty-four in number, as well as the orderly arrangement of material, make this a fairly good quick reference book. On the other hand, the incomplete coverage of treatment in many instances, combined with an almost complete absence of reference material, serves to detract from its use by those having a clinical problem at hand and desiring a solution.

ROGER D. WILLIAMS, M.D.

An Introduction to Chest Surgery. By G. Flavell, F.R.C.S. (Eng.), M.R.C.P. (Lond.) Oxford University Press. New York, 1957. *Price* $7.50.

In the preface the author states that his main purpose was to write a book which would be readily understood by students. In this goal the author has admirably succeeded. His sections on the lungs, pleura, mediastinum and esophagus are excellent. He describes the basic physiology, basic pathology and the surgical principles involved. His methods of treatment are well tested. The section on congenital heart lesions is somewhat behind current concepts, particularly insofar as open heart surgery goes, but this background material will still be of value to the student.

This is an excellent book which should be acquired by all students, interns and beginning residents to aid them during their exposure to clinical problems in thoracic surgery.

HOWARD D. SIRAK, M.D.

The Pharmacologic Principles of Medical Practice. By John C. Krantz, Jr. and C. Jelleff Carr. Fourth edition. The Williams and Wilkins Company. Baltimore, 1958. *Price* $14.00.

This is the fourth edition of a well received standard textbook of medical pharmacology. It is well written and physiologically oriented. The text is primarily aimed at the medical student, generalist and internist. It is of only incidental interest to the surgeon as a reference work. The reviewer, a surgeon, is not qualified to undertake any more critical appraisal of a text fundamentally directed at a different target. However, a perusal of certain of the chapters, e.g., those on antimicrobial agents, autonomic nervous system, steroid hormones, etc., would be of value to any physician or surgeon.

ROBERT N. WATMAN, M.D.

Management of Complications in Eye Surgery. By R. M. Fasanella, M.D., Editor. W. B. Saunders Company. Philadelphia, 1957. *Price* $16.00.

As editor, Dr. Fasanella has assembled excellent chapters by recognized authorities dealing with topics in which each is specially

interested. The book is well organized, detailed in its descriptions, readable, and can be highly recommended for the ophthalmologist. As an example of the scope of this book, the chapter on Surgery of the Vitreous describes the technics of this new procedure. Methods of obtaining and storing vitreous are outlined. Indications for vitreous use include complicated retinal detachment, massive vitreous hemorrhage and extensive vitreous loss. Valuable suggestions as to operative details are given.

WILLIAM H. HAVENER, M.D.

The ABC of Acid-Base Chemistry. By Horace W. Davenport. University of Chicago Press. Chicago, 1958.

The student of medicine rarely reaches the position of clinician with a clear understanding of the principles of acid-base chemistry which are the foundations for effective electrolyte therapy. Too frequently rules-of-thumb, which are not infallibly correct, have replaced strict electrolyte physiology.

The author has introduced the subject with an elementary discussion of physiological gas exchange in which he clearly elucidates the function of blood constituents in this regard. With this as background, he continues with a consideration of normal ion distribution and its effect in establishing a normal acid-base equilibrium by appropriate buffering systems. The final one-third of the book deals with pathological alterations in electrolyte balance and the etiological principles for these conditions. The last chapter points up the quantitative errors of analysis which may occur. The author does not hesitate to use mathematical calculations and chemical equations which aid in the presentation of the principles involved.

R. O. MOORE, M.D.

Endocrine Aspects of Breast Cancer. By Alastair R. Currie, B.SC., M.B., F.R.C.P. (Ed.), Editor. Foreword by C. F. W. Illingworth, C.B.E., M.D., CH.M., F.R.C.S. (Ed.), F.R.F.P.S. E. & S. Livingstone Ltd. Edinburgh and London, 1958. *Price* $8.50.

This book is a permanent record of the three-day Carcinoma of the Breast Conference held in July, 1957, at the University of Glasgow. The meeting was divided into four sections: Clinical, Pathology, Hormonal, and Experimental Pathology.

The Clinical section contained papers by many noted authorities on hypophysectomy, adrenalectomy and postoperative ablative effects. Dr. Illingworth concluded by stating that 50 per cent of the patients treated obtained a beneficial response. A good remission lasting more than a year was observed in less than 25 per cent. A problem still exists in selecting which patients will respond to endocrine surgery.

The Pathology section contained information on the embryology of the pituitary gland and on observations made of breast changes both postmortem and after hormonal stimulation. It was stated that atrophy of the breast occurs in only 50 per cent of the cases after menopause and that one could find lumpiness of the breast in over 28 per cent of the cases of patients examined without breast complaint.

In the Hormonal section studies were presented evaluating various endocrine and chemical determinations. The completeness of various endocrine ablative procedures was investigated by these studies and in conclusion it appears that a simple reliable method is still lacking. Brown or Bauld's methods for determining urinary estrogens are perhaps the most accurate, and these two detect only 20 to 30 per cent of the estrogen metabolites known to be present in the urine, according to Dr. G. F. Marrian.

The section on Experimental Pathology reviewed the hormonal responses of mammary tissue. Many different experimental conditions were presented and it was noted that unrecognized factors still play a part in the change of a normal or latent tumor cell into an actively growing or autonomous tumor.

In summary, this book contains a wealth of current information. It brings to date present thinking on ablative or additive measures which can lead to an arrest or regression of carcinoma of the breast. The book is recommended for those interested in this problem.

MITCHELL KARLAN, M.D.

Transactions of the Pacific Coast Obstetrical and Gynecological Society, Volume XXIV. Western Journal of Surgery Publishing Company. Seattle, 1956.

The Western Journal of Surgery, Obstetrics and Gynecology, which is the official organ for

publication of the Society has published in bound volume the transactions of the twenty-third annual meeting in commemoration of its Silver Anniversary.

This Anniversary issue will be a cherished possession of the members of the Pacific Coast Society not only for the complete report of the scientific program and its thirteen formal papers, but also for the excellent historical review of the Society's formation and brief summary of the meeting and program of each annual meeting. Past officers and charter members are listed. Present members are listed with a brief curriculum vitae of each. The Constitution and By-laws are printed in their entirety along with the minutes of the Business Meeting and Committee reports of the 1956 Meeting.

Scientific papers are presented with comments by discussion, and offer stimulation to both researcher and clinician.

WILLIAM E. COPELAND, M.D.

Physical Methods in Physiology. By W. T. Catton, M.SC. Philosophical Library. New York.

This volume of under 400 pages is highly specialized in its scope and directed at a highly specialized audience. The book is precisely what its title suggests. It is a small, highly technical account, in considerable detail, of physical technics useful in physiologic measurements. It is of only incidental interest to the average surgeon but is the type of volume which should be available in surgical as well as physiologic laboratories for handy reference. It contains in very brief form a wealth of readily available information and should be a very valuable starting point in suggesting and setting up procedures in the laboratory.

ROBERT N. WATMAN, M.D.

Surgery in World War II. Ophthalmology and Otolaryngology. U.S. Government Printing Office, Washington, D. C.

This text describes the various problems encountered in medical practice under wartime situations. Observations and suggestions are made with the intent of proposing administrative policies which would be helpful in another war.

The most outstanding section deals with the rehabilitation program for blinded soldiers. Important features of this program receive detailed consideration. As would be expected, management of eye injuries is well presented. The descriptions of intraocular foreign bodies and of lid and orbit injuries obviously are derived from a wealth of experience. Significant studies of the effects of war wounds on visual pathways are recorded. The chapters on non-traumatic eye disease are not as good as in many current texts. The style and content of much of the book leaves something to be desired.

The otolaryngologic portion of the book is quite similar to the ophthalmologic, with emphasis on problems of deafness.

WILLIAM H. HAVENER, M.D.

The Healing of Wounds. By Martin B. Williamson, PH.D., Editor. 196 pages, 39 figures, 10 tables. McGraw-Hill Book Company, Inc., New York, 1957. *Price* $7.00.

This is a short, easily read book which very nicely covers primarily those recent studies which have been made on wound healing. Consideration is given to the particular studies of protein, amino acid metabolism, ground substance, vitamin C, collagen, sulfur compounds and hormones as they pertain to wound healing. The book is composed of ten concise chapters written by authorities on wound healing, each chapter considering an interrelated aspect of the subject. While of interest and importance to all, this book is most highly recommended to those physicians interested in the recent studies of factors acting on the healing of wounds and in a readily available bibliography of this subject.

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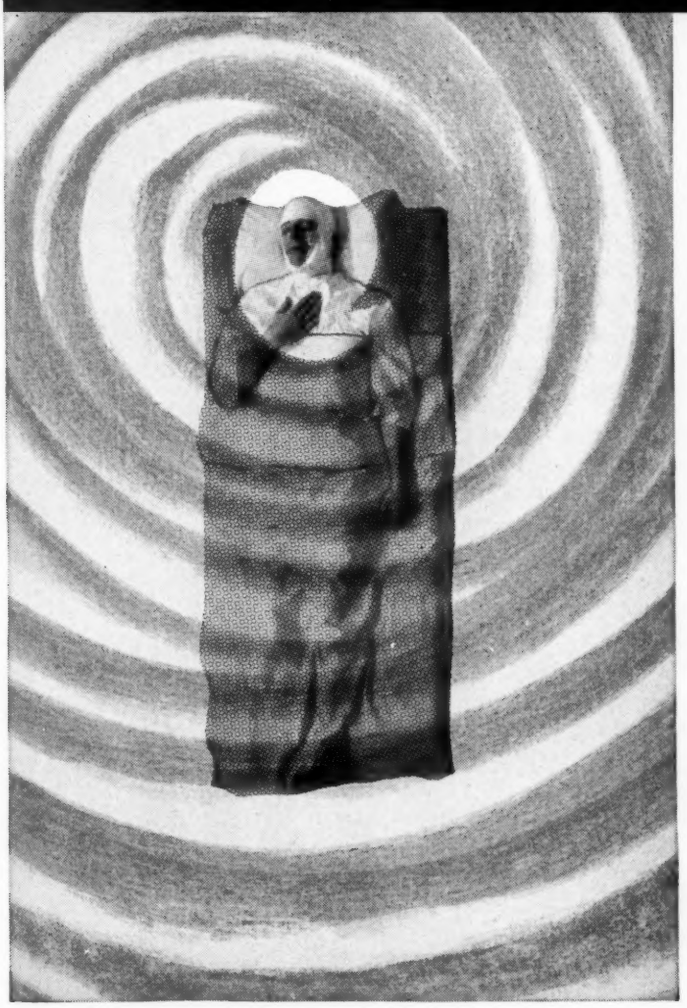

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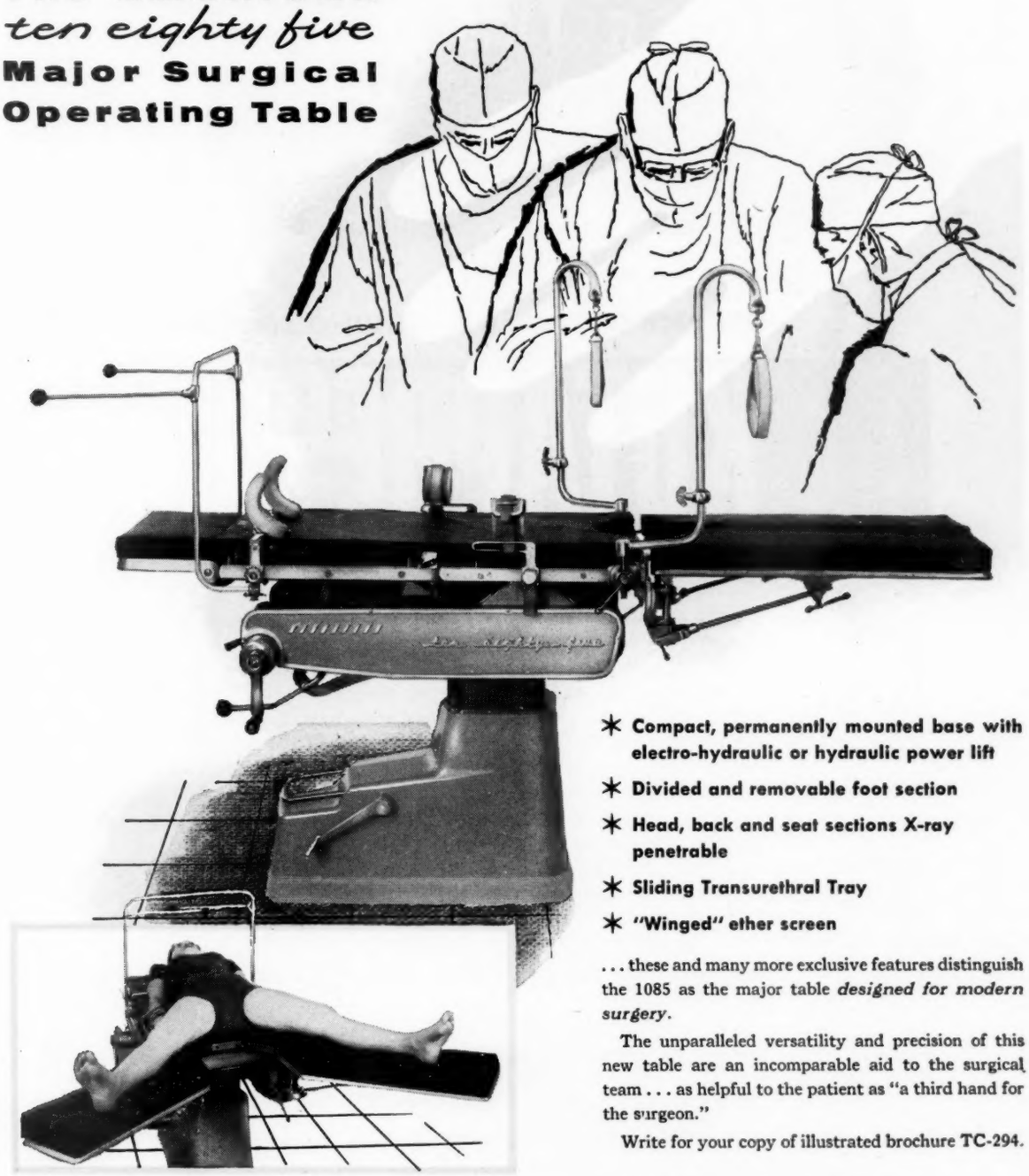

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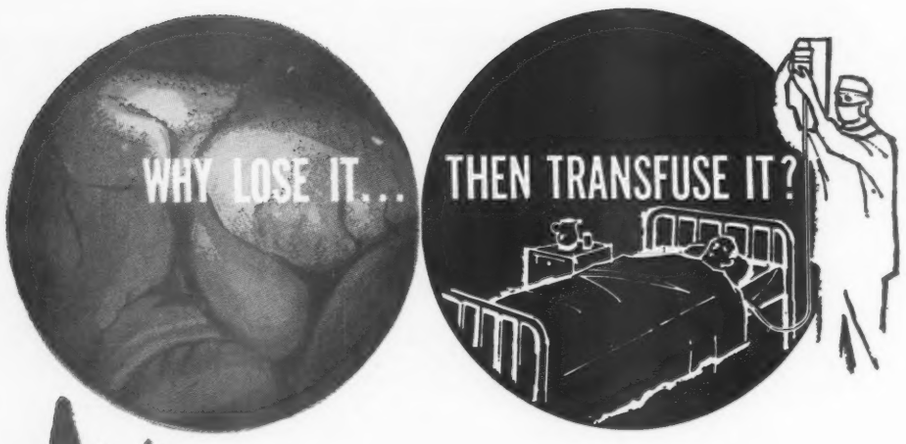

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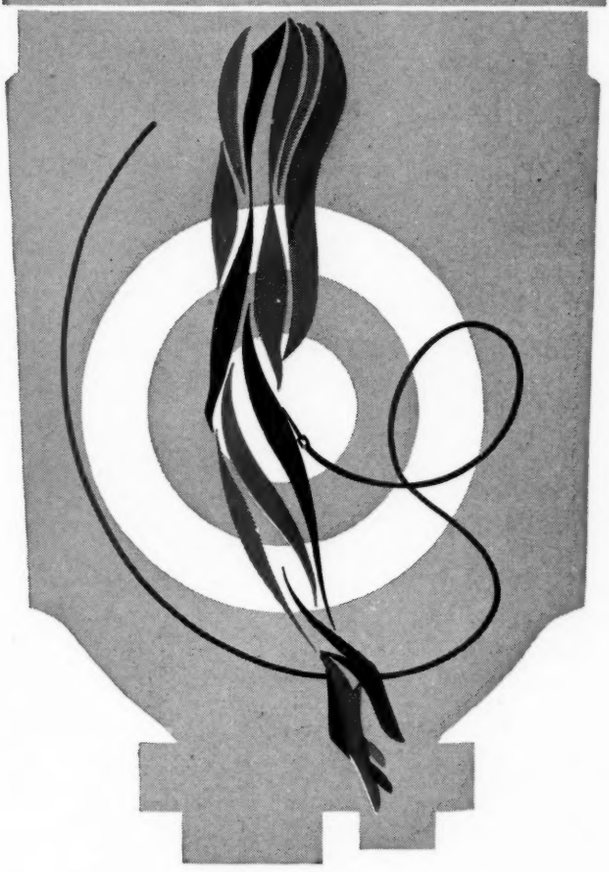

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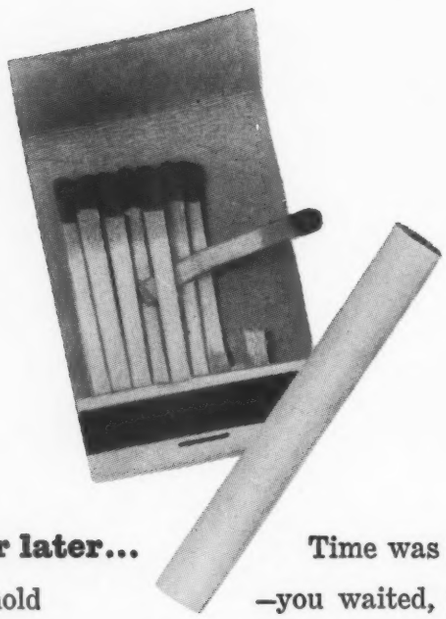

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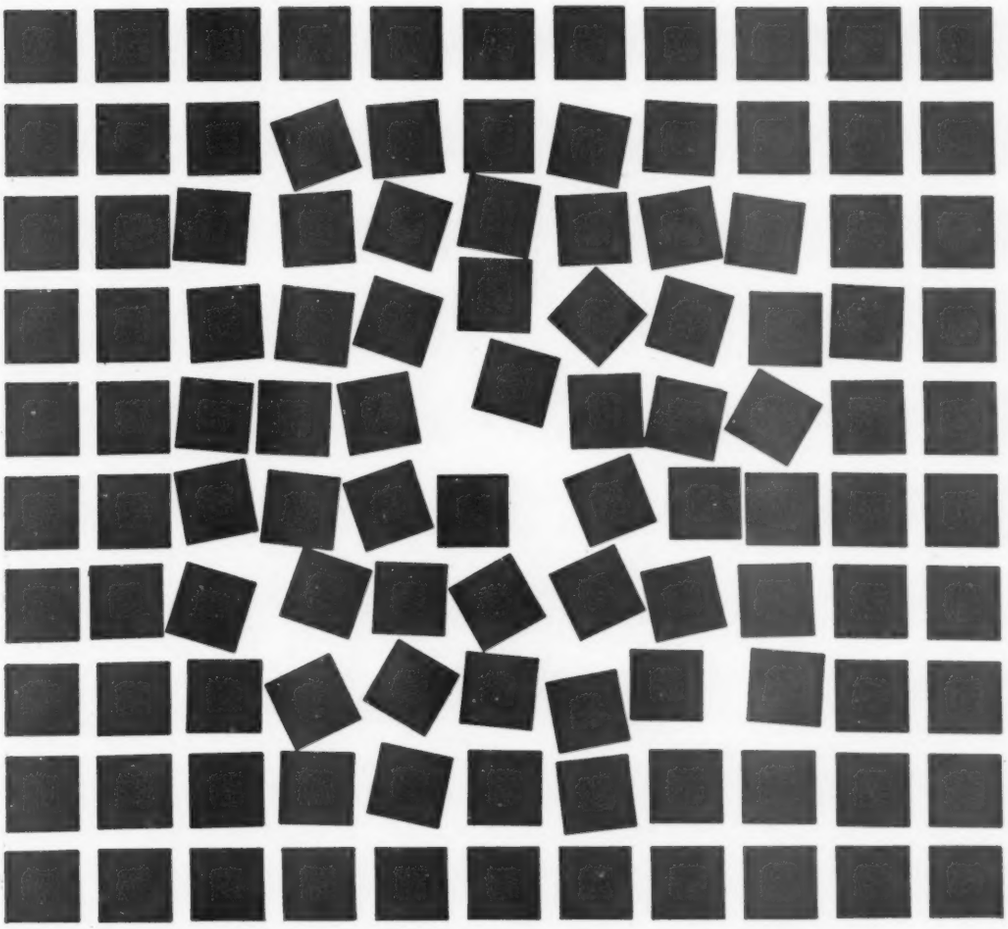

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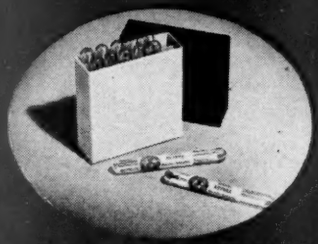

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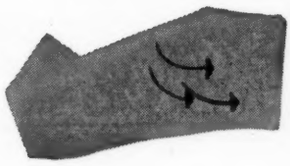

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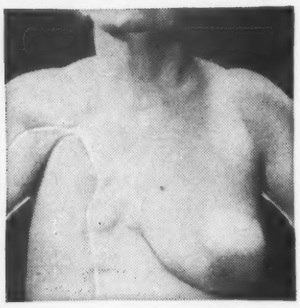

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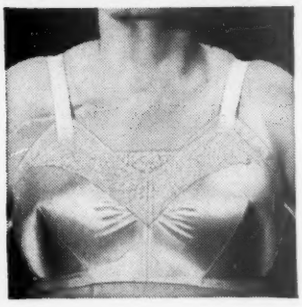

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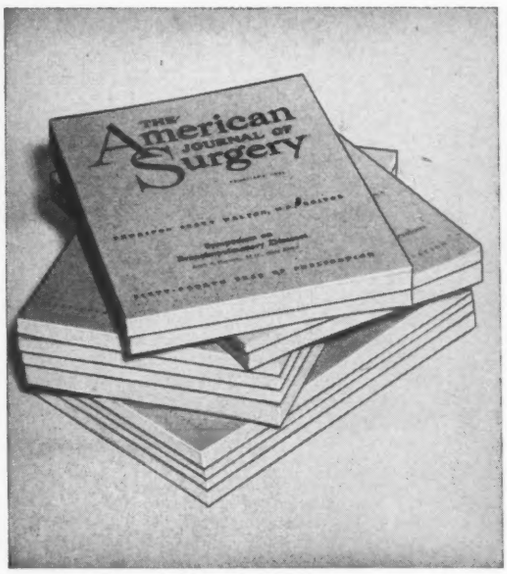

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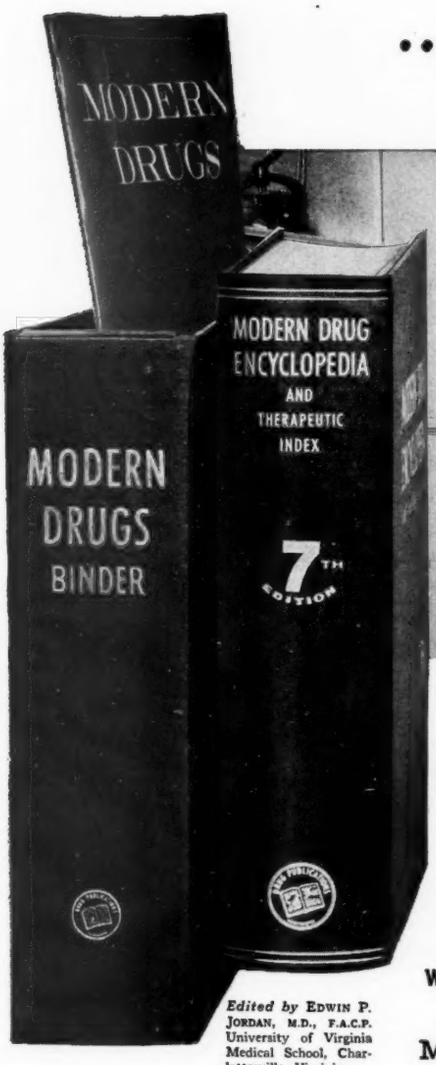

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For further information contact H. W. Coates, V. Mueller & Company, 320 S. Honore St., Chicago 12, Ill.

EXHIBITS "FOR THE RECORD." *Described as an outstanding contribution to medical communications is the new Exhibits-on-Film, preserving permanently on filmstrip and record some of the most significant scientific exhibits shown at medical meetings each year by research-minded physicians.*

Exhibits-on-Film provides every teaching hospital, medical college and medical society with the opportunity to show practicing physicians, faculty and students select exhibits they may otherwise miss, and to study the audio-visual technics used. Colleges and societies may build their own libraries, adding to them each year.

The filmstrips are in full color and show all details of the exhibits in close-up and at a leisurely pace. The sound narrations are prepared under the supervision of the exhibiting physicians.

The first editions are already available featuring selections from last year's American Medical Association meeting.

Medical journalists and photographers from Exhibits-on-Film covered this year's A. M. A. meeting in San Francisco, where additional exhibits will be preserved. Pediatrics and other major specialty meetings are also being covered.

Further information for showings and library copies may be obtained by writing to Exhibits-on-Film, Medical Education Department, Lakeside Laboratories, Inc., Milwaukee 1, Wisconsin.

ULTRASONIC CLEANING EQUIPMENT. Wilmot Castle Company, Rochester, New York, is now marketing a line of high-speed ultrasonic cleaning equipment capable of saving thousands of dollars each year for U. S. hospitals.

The new unit, called the Castle Ultrasonic Cleaner, sends high frequency sound waves through a detergent bath to remove grease, dried blood and other soils from the surface of instruments, glassware and small utensils.

So efficient is the new system that soils left untouched by the most conscientious hand-scrubber are removed from the most inaccessible microscopic holes and recesses. "Frozen" syringes are freed and even "permanently" stained instruments come clean.

A full load of 75 to 100 instruments, which would take almost one hour if washed manually, are cleaned far better by the new system in as little as six or seven minutes, according to company spokesmen. The equipment is the first to provide the safety and convenience of fully automatic controls, coupled with an automatic drain-rinse cycle which permits more positive cleaning than ever before thought possible. Soils dislodged during the wash phase of the cycle are automatically flushed from the

CONTINUED ON PAGE 48

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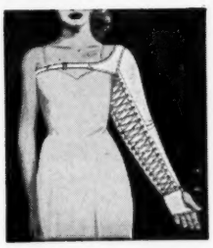

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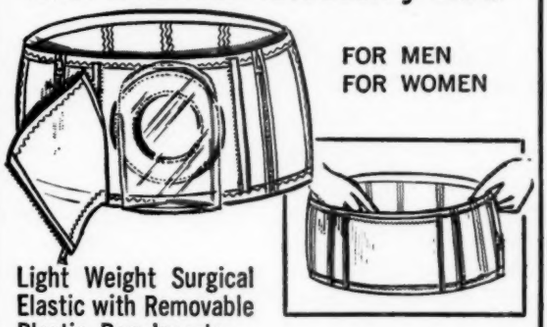

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The new Castle line includes compact individual cleaners and dryers, large all-purpose combination cleaner-dryers and inexpensive laboratory portables. The Wilmot Castle Company, 1913 East Henrietta Road, Rochester, New York, will supply full details.

FORMULA FOR PHENYLKETONURIA. *A new, complete formula product for the dietary management of phenylketonuria, a hereditary disease which causes mental retardation in children, has been developed in the Mead Johnson & Company research laboratories.*

The product is called lofenalac. It helps prevent the development of mental deficiency due to phenylketonuria by limiting the intake of the amino acid, phenylalanine, in the diet.

Phenylketonuria is a little known disease resulting from a congenital inability to metabolize properly phenylalanine, which is found in all natural proteins. This disease is characterized by high levels of phenylalanine in the blood and the presence of phenylketone bodies in the urine.

NEW OPERATING TABLE. The Shampaine Company of St. Louis, Missouri, has announced full details about a new operating table, the S-1501 Surg-A-Matic. It features a push-button selection panel at the end of the right control arm that enables the operator to adjust the table to operative positions quickly and easily. A touch of the proper button and a few simple turns of the right hand control wheel accomplishes these positions with a minimum of time and effort. All controls are located at the head end of the table and it is not necessary for the operator to divert attention from the patient or invade the sterile area to accomplish any operative position.

The table is available with two types of hydraulic bases; motorized and non-motorized. The non-motorized base is foot pedal–operated. The motorized base features a completely concealed electrically operated motor in the foot end of the base. No mounds or "blisters" mar the appearance of the base and the problem of maintaining and cleaning such an obstruction is eliminated.

AWARD. *A Yale doctor whose research findings explain how nervous tension can produce that lump-in-the-throat feeling received the annual Harris P. Mosher Award in recognition of his work.*

Dr. John A. Kirchner, Associate Professor of Otolaryngology at the Yale School of Medicine, reported that a throat muscle, the cricopharyngeus, has a definite connection to the nervous system and is therefore affected not only by nervous tension but by many neurological diseases. His findings based on laboratory investigations refute the generally accepted belief of many doctors that the cricopharyngeus has no such connection.

NEW PROGESTATIONAL AGENT. The synthesis of a new hormone, described as a powerful agent that may help in the prevention of miscarriage or premature birth, was announced in a recent issue of the *Journal of the American Chemical Society*.

Provera,® believed to be the most active compound for this purpose ever known, has been shown to be up to 300 times as potent as drugs now in use, according to tests carried out in the department of clinical investigation of The Upjohn Company, Kalamazoo, Michigan. Further clinical trials are now being conducted at a number of medical centers.

It is estimated that more than 10 per cent of all pregnancies are terminated by miscarriage. The biological properties of the new drug, whose chemical name is 6 alpha-methyl-17 alpha-acetoxyprogesterone, indicate that it may be particularly useful in the control of this condition and in preventing birth before the proper time.

A standard potency test, in which Provera was injected under the skin, showed it to be fifty to sixty times as active as progesterone, the natural hormone that regulates the duration of pregnancy. In the form of tablets, it was 100 to 300 times as active as ethisterone, an orally active drug similar to progesterone. Progesterone itself is relatively ineffective when taken by mouth.

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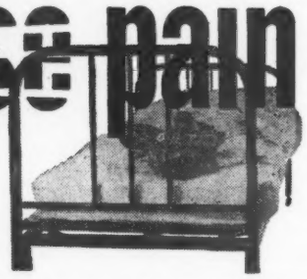

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1. Keesling, R., Hinds, E. C., and Keats, A. S.: Principles of Drug Evaluations in Dental Surgery: Antihistamines and Analgesics: (Paper read at the Thirty-fifth Gen. Meeting of the International Assoc. for Dental Research: Atlantic City, March 21-24, 1957). 2. Orahovats, P. D., Lehman, E. G., Chapin, E. W.: Pharmacology of Ethyl-1-(4-Aminophenethyl)-4-Phenylisonipecotate, Anileridine, A New Potent Synthetic Analgesic: Journal of Pharmacology and Experimental Therapeutics, Vol. 119, No. 1, (January) 1957. 3. Stage, J. T.: Anileridine as an Anesthetic Agent: Journal of the Florida Medical Association 44:143-145 (August) 1957. 4. Keats, A. S., Telford, J., Kurosu, Y.: Studies of Analgesic Drugs: Anileridine Dihydrochloride: Anesthesiology 18:690-697 (September-October) 1957 . 5. Riffin, I. M., Preisig, R., Wheaton, H. H., Landman, M. E., and Schwarz, B. E.: "A New Synthetic Analgesic, Anileridine," Scientific Exhibit, 106th A.M.A. Annual Meeting, New York; June 3-7, 1957.

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